The Glass Industry

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Cost of the Glass Product

A Practical Method for Determining and Recording It

By G. Wesley Evans*

Glass industry executives know whether or not they are making a profit and know a great deal about their costs. But not all, manufacturing a variety of glass wares, can put a finger on an article and say: "It costs us a certain number of cents to make that." Ascertaining the exact cost of a specific job, one of a big line, is no small problem. The glass industries have undoubtedly been children of fortune, and it has been easy to be completely satisfied as long as the figures at the bottom of the monthly statement indicate a good or reasonable profit. However, the question—"On just what are we making money?"—becomes more and more insistent. A knowledge of the details of the cost of producing any article is a good start toward reducing the cost.

Before assailing this proposition a warning is in order. No easy and simple formula or solution is to be offered. We can only hope to outline the method of attack. Furthermore, costs are far from stable. In fact they are much less stable than prices, and costs determined under certain conditions cannot be depended upon under changed conditions. Fixed and variable items must be considered. The percentage of plant capacity operated has a very great effect upon cost of articles being made, and this is a very frequent upsetter in the glass industry, because of the necessity of frequent tank repairs. However, after some experience, one can determine the ratio that exists between the per cent of operations curtailed and the corresponding per cent of increase in cost of articles then being made. So it is with most of these changing circumstances and conditions that keep affecting costs.

We shall assume a continuous tank and machine plant and tackle the problem from the position of the plant executive. We shall first set down our data, our headings and items. Then we will take up the methods of finding amounts to set opposite these items, analyze the components and explain the reasons for our arbitrary rulings on certain questions that arise.

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DATA

Job Number ..... Machine made on.....
Description ..... Run from.....to.....
..... Package .....
.....
Weight: Each .....per gross .....
Average Run Packed:

	Shift	Day (24')	Week
Pieces	.....	.....	.....
Dozen	.....	.....	.....
Gross	.....	.....	.....
Pounds	.....	.....	.....
Tons	.....	.....	.....

FACTORY COST

Material (Glass delivered to machine)

Mixed batch (including cullet) per ton filled in	$....		
Batch plant and furnace labor per ton filled in	....		
Power:			
Unloading, mixing, conveying per ton filled in	....	$....	
Add....% for shrinkage in melt.....		....	
Melting fuel cost this job (....% of ....lbs. per week), per ton pulled.....		....	
Other fuel, Rev. pot, flow device or ...., per ton pulled		....	$....

DIRECT LABOR AND EXPENSE

Productive Labor, this job $.... per week ÷ ....tons pulled = Per T.		....	
Factory power $.... ÷ .... prod. units working ÷ tons pulled, this job		....	
Lehr and oven fuel, this unit per ton pulled ...		....	....
			....
Add ....% in $ minus value per ton of cullet for selection and machine loss			....
Prime cost per ton = ...			....
One ton = ... gross ∴ Prime cost per gross			$....

INDIRECT

Brought forward $....

	Cost of Castings & Work per set	Good for No. Gross	Cost per Gross
Equipment			
Molds	$....	....	$....
Bottoms	....	....	....
Thimbles	....	....	....
Plungers	....	....	....
_____	....	....	....
_____	....	....	....
_____	....	....	....
_____	....	....	....
Repair labor, this job per week...	....	....	....
Polishing labor, this job per week...	....	....	....
Power, % this job of total	....	....	.... $....

PACKAGE

Materials and freight, per package	$....	
Nails, per package	....	
Liners, partitions, paper, per package	....	
Labor: Unloading and handling, per package	....	
Making up, per package	....	
Delivering to packing room, per package	....	
Power: = per cent this job uses of total box factory operation ÷ No. pkgs. = per pkg.	....	
One empty package in packing room		$....
Labor, selecting, packing, etc., this job per turn $.... = per pkg.		....
Labor, shipping, $.... to load car of .... pkgs. = per pkg.		....
Storing $.... to store 3 shifts or .... pkg. = per pkg.		....
Power: = per cent this uses of total warehouse conveyors ÷ No. pkgs. = per pkg.		....
Package, packing and handling, per package		$....
Package, packing and handling, per gross		$....

MANUFACTURING EXPENSE

Item	Total Cost Per Week	Weekly Per Production Unit Cost	= Per Gross
Superintendence	$....	$....	$....
Factory Office Force	....	....	....
Repair & Yard Labor	....	....	....
Electricians	....	....	....
Watchmen	....	....	....
Chemist & Laboratory	....	....	....
Blacksmith	....	....	....
Storekeeper	....	....	....
Truck Driver & Truck	....	....	....
Nurse & Welfare Work	....	....	....
Matrons	....	....	....
Janitors	....	....	....
_____	....	....	....
_____	....	....	....
Maintenance & Repair reserve	....	....	....
Interest & Depreciation reserve	....	....	....
Taxes & Insurance	....	....	....
Water	....	....	....
Heat & Light	....	....	....
Factory Supplies	....	....	....
Oil & Grease	....	....	....
Factory Office Supplies	....	....	....
Postage	....	....	....
_____	....	....	....
_____	....	....	....

Total factory cost per gross ..... $....

Under FACTORY COST (the word "Factory" as used herein refers to the departments having a direct part in the converting of batch into the glass product, ready to pack—sometimes called "The Productive Departments"), and *Material* we first set down "mixed batch (including cullet) filled in." Now if sand comprises 62% of our "mixed batch filled in" and we know the cost of sand per ton plus freight, we can take 62% of that cost and know the cost of the sand in a ton of our mixed batch. So with the other materials. We will simply take the market price of cullet (if using our own) plus the cost of handling it. Then:

Material	Cost per T. including freight	Per cent each is (by wt.) of mixed batch	Contributing cost of each
Sand	$.....	62%	$.....
Soda	.....	.....	.....
Lime	.....	.....	.....
_____	.....	.....	.....
_____	.....	.....	.....
_____	.....	.....	.....
_____	.....	.....	.....
Cullet	.....	.....	.....
		100%	

Mixed batch per ton filled in ..... $.....

It is assumed that weight records are taken of mixes, cullet and fills. Any difference between market price and our own actual cost of cullet will be taken account of later.

The next item requires but little explanation. The total amount for batch plant and furnace labor, including unloading, mixing, filling in, etc., for the period, is divided by the number of tons filled in.

We now deal with power for the first time. Distributing the cost of power is simple if each department and each unit thereof has a meter. This is seldom the case. Supposing we have a power house and determine that it distributes power thus:

Batch Plant and Furnaces	8%
Gas Producers	10
Factory Machines	26
Factory Lehrs	
Mold Shop	
Box Factory	
Warehouses	
Lights	
	100%

Then 8% of total power house expense (which should be computed on bi-weekly cost sheets, as for all departments) for the period taken divided by the number of tons filled in gives the amount we use here. If we pump our own water, it is well and easier to let power house costs include pump house costs. The bi-weekly, or weekly, cost sheets mentioned can be gotten up very easily if proper store room records are kept. All that is necessary is the summing up of total operating expenses under the headings of "supplies," "fuel," "power," and "labor." Care should be exercised to include only *operating expenses*, as maintenance and repair are taken care of by a reserve.

About 15% is commonly accepted as shrinkage in melt, although the actual percentage may be easily obtained. This percentage is to be taken of total cost to this point.

The next item "Melting Fuel cost, this job (———% of ———pounds per week), per ton pulled" is not as for-

midable as it looks. Knowing the weights and speeds of all jobs working on the tank, we can get the total "pull" in pounds or tons for the period this particular job worked. In the same manner we get the weight of this job for the period and then the per cent it is of the total pull. To get our amount, take this percentage of the total melting fuel cost for the period. If our fuel is natural gas or oil, we can figure from meter readings. If producer gas, we can use the gas producer plant's cost sheets.

Natural gas will, no doubt, be used at the flow spout or revolving pot, or whatever we have, and the cost of fuel there will be computed from the meter readings.

For "Productive Labor," the payroll distribution sheets should show the items and total of productive labor on each job worked. This covers wages of machine operators, ware handlers, and all factory labor. The total on this job divided by its total weight in tons gives the amount.

If the factory uses 26% of the power as estimated above, we will take 26% of the total power cost for the period as we did the 8% for Batch Plant and Furnaces. We then divide this amount by the number of production units, if they are all the same type of machine. If not, we will assign each machine its proper "power per cent" on the basis of power used to run it (all in operation totaling 100%). Now take the "power per cent" (for the machine on which this job worked) of the cost of total power used in the factory proper. That gives the cost of power used here in making this job. Divide by number of tons to get cost per ton. This charge should include power to run the lehr, if it is power driven. Our reason for basing this "power charge" and other charges (farther down the line) on production units as explained is that it seems by far the fairest and simplest basis.

Cullet having been weighed, its percentage of tons pulled on all machines is easily determined. Take this percentage of the total cost thus far, less the amount per ton we charged ourselves for cullet (or market price) at the filling in end of tank. The difference gives the amount to add in to our cost here.

The total cost we now have may be called "Prime cost per ton" and should be turned into "Prime cost per gross."

Our Mold Shop and Equipment charges are figured in by keeping data on the cost of (for example) mold castings plus machine work on them (labor and power), and dividing the total of these by the life, in gross, of a set. The total Repair Labor on equipment for the period worked will be divided by the number of gross made, to get its amount per gross. The same is true of labor for polishing. Power used in the shop to keep this job up should be determined and charged on a percentage basis, just as the power item was determined in the factory.

The amounts of each of the first three items under "Package" are determined from invoices and freight bills. The Labor Charges for unloading and handling and for delivering to packing room will have to be computed from time distribution cards. "Making up" may be so computed or, if on a piece work basis, the rate can be taken. The charge for power in the box factory is arrived at by the same methods as used in the factory and mold shop. The total of these items comprises the cost of one empty package in the packing room ready to fill.

The cost of packing room labor working on this job per turn, day or week divided by the number of packages per turn, day or week, respectively, gives the amount of the next item to set down. Likewise, the cost of labor to take out to, and load a car divided by the number of packages in a car, equals "Loading cost per package." If stored, time cards will show the labor required to handle a day's (three shifts or 24 hours) production of this job, and we can then easily find this cost per package. Taking the per cent of warehouse power which was used for this job, dividing it by the number of packages of this job handled in the period taken gives the amount of charge for power item. The sum of all these items below "Package" should then be turned into "Package, Packing and Handling Cost per gross."

"A knowledge of the details of the cost of producing any article is a good start toward reducing its cost." Knowing costs, we can sail a straighter, safer course to profits.

The amounts of the items under "Manufacturing Expenses" chargeable to this job are to be found by dividing the total of each item for a week, or the period the job is worked, by the number of machines, if all are the same type. If they are not all the same type, that is if some are more modern or capable of greater production, are better money makers, each should be assigned a "production percentage" on the basis of their capabilities, the sum of all in operation being 100%. Then take the production percentage assigned the machine which worked this job, of the total of each item, to get the "weekly per production unit cost" which is reduced to the cost per gross for that item by dividing by the number of gross packed. If "Office Force," for instance, totaled $500.00 per week and we had ten uniform machines the "weekly per production unit cost" would be $50.00. Had we packed 500 gross, the "Office Force Cost" per gross would be $.10. Or if our machines were not alike and we had decided that the one on which this job worked was responsible for 15%, our "weekly per production unit cost" for office force on the job would be 15% of $500.00 or $75.00, and per gross $.15.

"Superintendence" total should be the sum of the factory superintendent's salary and that of each of his department superintendents or foremen. "Office Force" will cover the salaries of the paymaster, all clerks, bookkeepers, stenographers, etc. And so on down the line until we reach "Maintenance and Repair Reserve."

The amounts to be set aside for "Maintenance and Re-

pair" and for "Interest and Depreciation" are arrived at by different methods depending on the policies of the Company in such matters and are up to the company administration. "Taxes and Insurance" may be taken from last year's records with any additions that will be made. The cost of light may be a percentage of total power house costs. We figured in pump house costs with power house costs, but there may be water rent or expenses to pay for drinking water. Heat costs are easily figured from the amount of fuel used for that purpose, a record of which should be kept. The same is true of the last four items.

We have now arrived at the total factory cost per gross. To this may be added the proper portions of Administrative Expense, Sales Expense, etc. It has been our purpose only to roll the article, gathering its costs like a snowball (if one may compare a hot glass article to a snowball) through the factory.

It is well worth while to thus figure the cost of a job every time it works for an appreciable period of time, keep a record of results and note "whither we are drifting." Should such records be kept of all jobs for some time, a card index would serve very well, each card being a form something like the example given above.

These facts at hand show increases or decreases and at what points.

Job No. Machine..... .....% Operation

Description ..... Package .....

Dates ..... to ..... Factory Cost Per Gross .....

Material		*Indirect*		
Filled in	.....	Equipment per gross		.....
At Machine	.....			
Direct Labor & Expense	.....	Package each	..... } Per.	.....
Cullet loss	.....	Packing & Handling	..... } Gro.	
Prime Ton cost	.....	Manufacturing		
Prime Gross cost	.....	expense per gross		.....

Storage and Handling of Fuel Oil in Industrial Plants*

Contributed for Presentation at the Annual Meeting of the American Society of Mechanical Engineers New York, December 1 to 4, 1924

By C. G. Sheffield[1] and H. H. Fleming[2]

The equipment for storing and handling fuel oil forms an important part of the oil-burning installation, and a little time and thought devoted to the proper design and operation of such equipment is well repaid. For only in this way will continuity of operation be assured at the least expense for fuel oil and handling charges. The plant which is equipped to handle and store any grade of fuel oil in adequate quantities is in a position to take advantage of the fuel market and need not worry about temporary shortages of special grades of oil. The material in this paper is not novel, the object being merely to set forth what is, in the authors' opinion, good practice. The discussion is limited to industrial plants.

Storage tanks may be made of various materials and in various shapes, but the most common, and in general the most satisfactory, are the steel cylindrical tanks, usually vertical except for small sizes, and with conical or dome roofs. Concrete tankage may be used for heavy oils, but is more expensive and requires very careful construction to avoid cracking. Underground storage has the advantage of low fire hazard, but otherwise has little to recommend it. A steel tank should never be placed underground where there is any danger of the water table being above the bottom of the tank, as water rising about an empty tank will either collapse it or raise it. Furthermore leakage is not readily detected, cleaning is difficult, and water and sediment are not easily drawn from the tank.

The storage and handling equipment will depend somewhat on the nature of the fuel oil used. The oil in most general use for steam-raising purpose in the Atlantic Coast states is that known as Government "C" grade, which has a maximum viscosity of 300 sec. Furol at 122° F. Storage tanks for this type of oil must be provided with heating coils so that pumping can be done at about 100° F. In the Middle West, residual fuels of a lighter gravity and lower viscosity are widely used. While these flow freely at lower temperature than the "C" oil, some of them contain paraffin wax, which may make trouble by congealing in the lines.

"Distillate fuel" and "gas oil" are overhead products from petroleum distilling and are used primarily for special industrial furnaces requiring an oil lighter than boiler-fuel oil. Installations should be designed to handle the heavier fuel whatever possible, as it can always be obtained

[1]Fuel Oil Dept., Standard Oil Co. of New Jersey.

[2]Ref. Engr., Standard Oil Co. of New Jersey. Mem. A.S.M.E.

*Mechanical Engineering, December, 1924. The original paper includes specifications adopted by a large oil company as to weights of plates and types of riveting for refinery tanks from 10 to 120 feet diameter.

at a more favorable price than the light oils, which are in demand for other purposes besides fuel.

Storage Capacity Required

The amount of storage to be provided depends primarily on the maximum rate of consumption and the source of supply. A plant should have sufficient storage capacity so that during the period of greatest consumption the tanks will not be emptied between deliveries, allowing for the maximum delay that may be encountered in obtaining fuel. Tank cars are made in various sizes, those in the fuel service ranging from 6,000 to 12,600 gallons. In considering the capacity of tanks a consumer should not depend upon always being able to get the smaller-sized cars, nor should he install a tank which will hold only slightly more than a tank car, depending on a car to arrive in the yard just at the time the level in his tank has reached bottom. It is always preferable to have the storage divided into two tanks, so that repairs or cleaning can be done on one while the other is in service. This also permits accurate gaging, as with only one tank it is necessary to fill at the same time that oil is being withdrawn to the burners. Also in case of fire the oil from the burning tank can usually be pumped to the second.

THE authors discuss the storing and handling of fuel oil. They deal authoritatively with such practical problems as location, foundations, construction of the steel tanks themselves, handling, and heating. In view of the increasing use of oil as a fuel in industrial plants, the paper is timely and of interest to many engineers and manufacturers.

The cost of steel tankage will vary from $.50 to $1.00 or more per barrel, depending upon the size and location of the tanks. The lower price applies to 115-ft-diameter units favorably located.

Location and Foundation

The location of tankage is governed almost entirely by local conditions at the plant, including the regulations of underwriters, city ordinances, fire-department rulings, etc. In general, tanks will be placed so that lines both from the source of supply and to the burners will be as short as possible, as long lines, in addition to being costly, must be kept warm when handling heavy oil in cold weather. Plants located along a river must place their storage above high water to prevent it from floating away, as an empty steel tank will float in a few inches of water and it is not always possible to fill it with water in time of floods. The location must be so chosen that there is space around the tanks for dikes. These may be of earth, masonry, or concrete, and should hold at least as much as the tank.

If possible, a location should be selected where foundation work will not be difficult. Many tanks are placed on the ground without foundations of any kind. However, this should be done only where soil conditions are very good or the tanks are quite low, for a solid foundation is the first requisite in keeping tankage tight. Any settling of the shell is very liable to strain the seams enough to cause leakage. Preparation of the location should be all filling or all cutting, as a tank resting partly on filled ground and partly on a cut will settle unevenly. Where such a location is unavoidable, the filled portion of the grade should be left higher than the cut to allow for settling when the tank is filled.

On good bearing soil no concrete need be used. Excavation should be carried to a firm, hard bearing, the top soil and other loose material being replaced by some good filling material, the top 8 to 12 inches being clay or loam or a mixture of sand and clay. A tank bottom placed directly on cinders will corrode very rapidly. The tank grade should be of greater diameter than the tank, and provision made against its being washed away by rain.

When tanks are erected on piling the usual practice is to build a load-bearing concrete slab over the piles with a concrete ring at the outer edge. Reinforced concrete slabs are also used where the soil conditions are uneven with soft spots. Concrete slabs should always be covered with a cushion of sand or sand and clay, otherwise rivets may be sheared off and the calking sprung. Where a tank is to be erected on a deep fill over good ground, a concrete ring may be used for containing the fill. The fill should be properly crowned so as to compress with the weight of a full tank.

Good judgment must be exercised in this apparently simple matter or trouble is likely to ensue.

Construction of Steel Tankage

For small tanks nothing less than 3/16 inch material should be used in shell and bottom or ⅛-inch in the roof.

The bottom sheets are mounted on horses two or three feet high. After these and the first course of the shell have been riveted and calked, water is pumped in to a depth of about six inches and any leaks made tight by calking. The bottom is painted with asphaltic or graphite paint and then let down on the foundation with considerable care to avoid strains that might open up the seams. All rivets of ½-inch and larger sizes should be driven hot, and the air pressure on the pneumatic riveters must be maintained at the pressure for which the tools are designed. All seams should be calked with a round-nosed tool and the tank subjected to a water or oil test before acceptance. A well-constructed steel tank, properly maintained, should last 25 to 40 years, depending on the nature of the service it is in. Some of the older refineries in the country have tanks that are still in service after nearly fifty years, but the material in most of these is iron of greater durability than the generality of tank steel manufactured today.

Connections

Besides inlet and outlet connections, tanks are provided with flanges for water draw-off, steam fire lines, heating-coil inlet and outlet, roof vents, and foam lines—where that form of protection is used. Oil is usually taken from

the tank through a "swing suction," i.e., the line after passing through the tank shell is connected inside the tank by means of a two-elbow swing to a length of pipe the open end of which can be raised or lowered by means of a cable passing through the roof of the tank. This allows oil to be drawn from any level desired in case of stratification. The swing suction is also valuable in case connections outside the tank are ruptured or valves become jammed, as the pipe may be raised until it is above the liquid level, thus preventing flow from the tank.

Steam lines for smothering are brought through the top ring and should have a gooseneck higher than the roof angle so that oil cannot flow into the steam pipes when the tank is completely filled. The lowest part of the branch before entering the main is fitted with a valve for draining condensate.

To allow for the expansion and contraction of the oil and the escape of vapors, a vent is provided in all tank roofs. It might be well to mention that the coefficient of expansion for fuel oil is about 0.00036, and if a tank is filled to too near its capacity with cold oil, it will spill over when the oil warms up. The vents must be of sufficient capacity to allow the outlet or intake of air at the maximum rate of pumping to or from the tank, with additional allowance for sudden change in temperature of the air space above the oil such as is caused by a shower on a hot day. The size of vent should also be checked against the amount of steam which could be put into the tank with the steam lines provided opened full. Valves or other means of obstructing vents are dangerous, as it takes only a very small pressure or vacuum to damage light tank roofs.

To prevent any fire outside the tank from flashing back through the vents the latter are protected with screens not coarser than 40 meshes to the inch. The diameter of this screen is increased so that the area of the actual openings is about 25 per cent greater than the area of the vent pipe. Regardless of what material is used, screens tend to corrode quite rapidly and clog, so that they should be frequently inspected and replaced.

All lines running through the shell of the tank should have valves close to the tank to avoid the danger of a break between the tank and valve. Pumps delivering to or from oil tanks should be valved on both suction and discharge side, and pumps which deliver to tanks should be provided with a check valve to prevent flow from the tank back into the pump. When long lines run above ground and are left filled with oil, the heat from the sun is often enough to cause expansion of the oil. If the valves at both ends of the line are closed, oil will be forced through the joints, either at the collars or valves, until pressure is released.

Heating

Heating heavy oils to a temperature at which they will flow freely is done by steam coils in the bottom of the tank. For small tanks a flat coil over the entire bottom is used. For larger tanks where the cost of heating the whole tank would be great, a coil around the suction pipe only will generally be sufficient. In the latter case a box-type coil is most satisfactory. Either live or exhaust steam may be used. The flat-type coil should be supported a little above the tank bottom on a wooden framework so arranged that the piping will drain toward the outlet. Small fuel tanks are often insulated either by a hollow-tile jacket or some commercial insulating material.

Handling

Well-designed equipment for unloading tank cars will save considerable time and expense. Cars for heavy fuel are equipped with steam coils for reducing the viscosity of the oil in cold weather, and if the tanks are located quite close to, and below, the siding it is possible to unload by gravity. A 10-inch line should be used for gravity flow and sharp bends must be avoided. This will permit a tank car to be unloaded in about thirty minutes. In providing flexible connections it should be remembered that if a 3-inch or 4-inch hose is used it will require several hours to unload a car. In most plants it is necessary to pump from the tank cars, or barges in case of water delivery, to the storage tanks. Since a steam line is run to the unloading point for the heating coils, a small duplex steam pump makes a simple and reliable installation and the exhaust is often used for heating the oil.

Tank cars are discharged through a 4-inch bottom outlet looking downward near the center of the car. The discharge valve is located inside the car and is operated from the dome. When unloading is completed all lines should be drained or blown clear. Heavy oil should never be left in a line after unloading, as in cold weather it will be found very difficult to start it moving again.

All fuel oil contains a small amount of sediment, and while it is only a fraction of one per cent of the oil delivered, it tends to settle out in the storage tanks, especially where they are heated, and deposit on the bottom. Moisture also gets into the tank through bad roofs, leaking steam coils, and the sweating of the underside of the roof. The water should be kept drawn off through a valve provided for that purpose, and the bottom sediment should not be allowed to accumulate to a point where it clogs the suction line. With some types of burners it is possible to take a small amount of the bottom sediment from time to time mixed with the fuel. For this purpose tanks should be provided with high and low suctions, or preferably a swing suction.

In cleaning tanks great care is taken to see that the tank contains no injurious vapors before sending men into it. After emptying, the manholes are opened up and the tank is steamed until no traces of oil vapors remain. Failure to observe this precaution is liable to cost the lives of the men entering the tank.

The question of protecting fuel tanks from fire has not been discussed in this paper as it is the authors' understanding that it is covered by another paper to be given at this meeting. Before plans for an installation have progressed very far the layout should be discussed with the underwriters or local authorities having jurisdiction, for although the fire hazard with 150-deg. flash point fuel oil is slight, there are certain requirements to be met, differing with the locality.

Colored Glasses in Hollow Glass Works*

Carl Duvivier†

Regarding colored glasses, we will only treat of glasses in current use in hollow glass works. The number of colors is much greater in crystal glass work, where fashion and fancy are given free play in pieces at always high prices and for which we are not concerned in making tests that would be too expensive for hollow glassware that is sold cheaply. Colored glasses are always more expensive to make than white glass; but it is indeed rarely that the purchaser consents to an increase in the prices of manufactured pieces. The result is that economy must be sought and only simple colors must be made; crystal glassware is the art, hollow glassware is the industry.

Blue Glass

A. COBALT BLUE GLASS. Cobalt gives a beautiful blue color to glass directly proportional to the quantity of cobalt oxide used. Therefore, one can obtain all the shades from very pale blue with great thickness to blue so dark that it seems black even with a thickness of a tenth of a millimeter.

The blue seems to be a pure tint, but really it tends toward violet. In order to obtain a neutral shade it is necessary to add to the composition a small quantity of iron oxide, which, as we have seen in connection with manganese, gives a yellowish shade complementary to the violet.

Cobalt oxide is expensive, but it has great coloring power. A good ratio for thin articles is 1/750 cobalt oxide which is simply added to the ordinary glass composition, removing the manganese from it of course; if desired, a little iron oxide can be added as we observed above.

It should be noted that, for blue glass, as likewise for all colored glasses, the medium should be very oxidizing. It is good therefore to force (increase) the proportion of sodium nitrate a little.

B. BLUE GLASS WITH COPPER. Copper in an oxidizing medium gives the glass a blue color tending toward green. The proportion of 1/500 without the addition of other material to the composition of the white glass, gives a clear greenish blue, called "moonlight" (Clair de lune), with a very pretty effect. It is sufficient to add the oxide to an ordinary glass composition and to increase the sodium nitrate a little to obtain a very certain and very regular effect.

If the proportion is increased, the color produced is proportional; 1/100 of the weight of the composition gives a beautiful turquoise blue. This color cannot be confused with the color given by cobalt because it tends towards green while the cobalt color tends towards red.

Copper oxide likewise gives a red in a reducing medium. The copper red, which in mass is opaque, and transparent only when very thin, is hardly ever used in hollow glass ware.

Green Glass

Practically speaking, no single oxide gives green; but as we know, ferric oxide in an oxidizing medium gives a greenish yellow, and cupric oxide gives a greenish blue; the mixture of the two consequently will give a pure green, and, according to the proportional quantities of the two oxides, the shade can be varied from "grass green" to "peacock blue," that is to say it can be varied in any desired degree from yellowish green to bluish green.

There is a third substance that also imparts a green color to glass. It is chromium oxide. When this substance is used the color is a hardly pleasing yellowish green; further, chromium oxide is hard to vitrify in the quantities that would be necessary to obtain a sufficiently dark glass. The difficulty is avoided by using a small quantity at the same time with iron oxide and copper oxide. It is useful in the sense that it gives a brilliancy to the glass which the two preceding oxides are not capable of producing.

It is used as sodium or potassium dichromate; but one must watch, more than for other colored glasses, when chromium enters the composition of green glass, that the medium be very oxidizing. If this precaution is neglected the color tends toward a very ugly greenish black, and besides, the chromium oxide vitrifies badly. This defect is manifested by black points in the glass.

Violet Glass

It is manganese that gives glass the purplish-violet color, but only in an oxidizing medium, because the colors given by manganous salts are very weak. Consequently the least trace of organic matter lowers the color several shades, and it is difficult, in ordinary manufacture, to always obtain the same shade.

The intensity of the color likewise depends on the furnace temperature; it decreases on annealing the pieces and the glass cannot be kept in the pot for a long time without losing its color.

However, with a little experience, one can get all the shades from rose to deep violet; but with lead glass (for crystal cullet) the glass always has a dark, little pleasing foundation.

Manganese dioxide is used in the quantity of about 1/25 for purple and 1/50 for rose. It is necessary to increase the quantity of sodium nitrate in the composition.

Yellow Glass

As a matter of fact, no single metallic oxide gives glass a pretty yellow color, but we can reach the desired result by a mixture of iron oxide and manganese.

The result, in effect, as we said above, is that iron gives a greenish yellow color to glass in an oxidizing medium, the yellower the more the medium is oxidizing. We get this result by a large amount of sodium nitrate and manganese dioxide; but it is much easier and much cheaper to make use of carbon or even sulphur.

Carbon is used as a fine powder, pulverized coke, sugar, or even wood sawdust. Of these substances, I prefer wood

Le Verre, Vol. 4, No. 9, pp. 197-199. Translated for THE GLASS INDUSTRY.

†Engineer, formerly Director of the Boussu Glass Works.

sawdust, which is the purest in foreign substances, while coke always contains ash rich in iron and alumina which are of such a nature to give "twisted" glass. Muscovado sugar is more expensive and does not seem to give an advantage sufficient to recommend its use.

The trouble in introducing organic substances in the composition of the glass, is that purifying becomes hard, and also the large amount of carbon monoxide produced. The yellow coloration, in short, is only produced by very finely divided carbon distributed through the mass, which even fused, is never homogeneous but always "working." The result is that the finished pieces are almost never free from bubbles which would cause them to be rejected in a careful factory.

It is evident that, since organic materials are to be made use of, that all oxidizing in the composition of the glass must be stopped under the penalty of seeing the product still more vesicular. It is unfortunate that this is not always done, for lack of the knowledge of the most elementary principles of chemistry. I actually have a "recipe" for making yellow glass that recommends the use of carbon at the same time as sulphur with the addition of potassium nitrate! We can get an idea of what such a mixture would produce in a glass pot, and the ignoramus who recommended such a mixture did not know that he unconsciously assembled the three substances comprising gunpowder!

In any case, and to facilitate the giving off of the gases, the yellow glass composition should be softer and more fluid than other glasses. This is done by increasing the amount of soda in relation to the quantity of sand and lime. It must not be increased too much for the glass would become more hygroscopic and too fluid to permit easy working.

On account of all the troubles of wood carbon and its substitutes, for my part, I have given them up and replaced them by sulphur or sulphides.

Sulphur gives glass a pretty yellow color proportional to the quantity of sulphur introduced into the mix. By using flowers of sulphur, we obtain, according to the amount used, all the shades from lemon yellow to very deep reddish brown. Sodium sulphide gives the same result.

As for yellow glass with carbon, it is necessary to work in the absence of all oxidizing material and to make the glass a little soft.

The first potful of yellow glass with sulphur will foam and bubble a great deal; it will be necessary to adjust the covers of the pot and to only partially fill it; this trouble will disappear in the following potfuls when one will have yellow broken glass available that will be added to the composition. With a mix containing a sufficient quantity of broken glass the melt will be very calm and one will be able to easily get well refined glass which would be impossible to obtain with carbon or wood sawdust.

It is also to be noted that the price of this glass is very low, which is of importance in hollow glassware where, as we have seen, the prices of colored articles are generally not higher than the corresponding articles in white glass.

Let us also remind you that silver colors glass yellow; but the cost of this operation renders this process unusable in hollow glassware.

Dichroic Glass

Uranium added to the glass composition gives it a yellow color by transmission and green by reflection. It is principally the glass with a potash and lime base that gives the best results, although the crystal glass is only colored yellow by this operation.

The effect is very pretty, especially on fancy pieces; unfortunately uranium compounds are expensive which restricts their use. Generally sodium uranate and more rarely uranium oxide are used. A relatively large quantity is required.

The color can be varied by the introduction of a little potassium dichromate, and thus obtain olive green which however is hardly used except in crystal ware and plate.

Red Glass

Two metals are used for coloring glass red; these are gold and copper with a minimum of oxidation.

A. RED GLASS WITH COPPER. We have seen above, how, in an oxidizing medium, copper gives glass a blue shade tending toward green. If in some way we can keep the pot in a reducing atmosphere, the glass assumes a beautiful red color, opaque in masses, and transparent only when very thin.

The result is that the color should be very dark and that the glass should be worked doubled, that is to say that the glassman after having gathered a small quantity of this red glass, lets his gathering cool a little, then puts it in white glass, of which he takes a much greater quantity. In subsequently blowing the piece there results an outer layer of white glass doubled inside with a thin layer of red glass, transparent on account of its thinness.

Glass colored red by copper is little used in hollow glassware. It is used principally for the manufacture of ruby window glass which has a wide use in photography for lighting dark-rooms. The red color given by gold tends toward violet and transmits too many actinic rays, while the copper color tends towards yellow which is preferable.

The copper red, as well as the gold red, forms a part of the category of glasses that Lecrenier calls "saturation colors" which is to say that the color produced is not proportional to the quantity of oxide added. No color shows as long as the proportion is too small; then, when the proper proportion is reached the color appears abruptly and with great intensity.

We will not go further with copper red glass, for, as we observed above, it is little used in hollow glassware. Those to whom the question is of interest will find all the necessary details in "Glassworker's Guide" by Bontemps which, although edited in 1868 is still the most remarkable work that has been written on the glass industry.

B. RED WITH GOLD. I have personally had occasion to study this question thoroughly and I have acquired some experience not only by the fact of having made it often and by different methods, but because I have had failures that I have had to restore. Nothing is more instructive than a failure when we succeed in discovering the cause.

Let us recall in a few words, the properties of this glass which is certainly the most interesting of all those used in hollow glassware.

Gold gives a pretty currant-red color to glasses with a lead or potash base. Glasses with a soda base are not colored and further, soda is very harmful to the development of the color. Thus, if in a crystal glass (silica, lead, potash) we add increasing quantities of soda, the color turns to red brown and only shows when the glass is very hot; it disappears when the glass reaches a temperature sufficiently low to be worked.

In practice, it is a lead and potash base glass, crystal, to which gold is added to make ruby glass. The glass produced is colorless in the pot; it can be gathered and cooled suddenly without showing any color; it remains perfectly colorless. But if it is reheated the ruby color shows with great intensity.

Air plays no part in the phenomenon and the coloration is produced in a vacuum as well as in an indifferent gas. It is agreed, at present, that the color is produced by very finely divided gold which is precipitated in the mass of the glass by reheating.

The temperature of the furnace where the fusion takes place has an important bearing on the success of the operation; with the same composition the three following cases may arise.

1. The glass is colorless when it is taken from the pot; by slow cooling in the annealing furnace it assumes its color.

2. The glass is colorless when it is taken from the pot; on slow cooling it remains colorless but reddens at the first subsequent reheating.

3. The glass does not turn red, no matter what may be the number of reheatings.

Consequently the manufacture of gold glass is delicate and one is never absolutely certain of the result.

Gold has considerable coloring power, and the glass thus colored is always used doubled, that is, ordinary lead glass is covered with a very thin layer of red glass. A good proportion for hollow glassware is 1/1500 which in a layer of a tenth of a millimeter thick, gives a sufficiently deep color.

As regards the composition to be used, opinions are very divergent and innumerable "recipes" of serious authors have been published, but I like to think that they have not been tested for they are worth absolutely nothing. Empiricism reigns supreme in this field where science has not yet shed its light, and unfortunately, as I said in the beginning of this article, we have not yet reached the point of being able to formulate absolute rules that govern these phenomena on account of a lack of the exact knowledge of the nature of them.

Two conditions, however, seem to me to be certain; the first is that the atmosphere in the pot should be oxidizing (although this is not the opinion of everyone); in the second place, the presence of antimony in the mixture, while not being indispensable, certainly facilitates the success of the operation.

I have succeeded with a beautiful red glass by adding simply gold chloride to the crystal cullet and adding some kilograms of potassium nitrate as oxidizer; but other times, with the same composition it has happened that I obtained only a colorless glass that did not turn red; the gold had evidently passed to the state of the colorless stable compound, which I was only successful in avoiding by the introduction of antimony into the composition.

On the other hand it is preferable to introduce the gold into the composition in the precipitated state (purple of Cassius) for success is more certain. If antimony is added to it and an oxidizer, we have, with the ordinary crystal composition, everything that is necessary to produce red glass.

The other substances that are sometimes added, nickel oxide, tin oxide, ferrous oxide, manganese oxide, potassium chlorate, borax, arsenic, etc., are absolutely useless and serve only to complicate the formula; at most, one might permit the introduction of a small quantity of iron oxide in the endeavor to obtain a color tending a little more towards yellow than towards violet. We also arrive at this result more easily and at the same time more expeditiously by adding a small quantity of uranium oxide to the composition.

If we are not certain as regards the so curious properties of glass reddened by gold, at least we can state some hypotheses. These are the ones that to me seem possible.

We admit that it is metallic gold which, in a state of extreme division gives the crystal glass the red color. It is probable that the gold can form several compounds with the potash and silica, and that one of them is stable and colorless, which is verified by experience.

In the most general case, when the glass is drawn from the pot colorless, since it is turned red by a subsequent heating, could not we see there a physical phenomenon and of the type of supersaturation phenomena?

We might also see there simply the destruction of an unstable chemical compound and the precipitation of the excess of gold that formed this combination; this hypothesis would explain the effect of antimony which, as we have seen, facilitates the production of the color. It is possible that, saturating a part of the potash or silica in the combination effected between the gold and these substances, it makes a stable and colorless combination harder, which is to say that it takes the place of a certain quantity of gold, of which a less proportion is required consequently. This is verified experimentally.

Summarizing what has been said about colored glasses

—the greater part of them present no special difficulties. Except for yellow glass and red glass the coloring oxides can be mixed and give all the intermediate shades. The glass-maker has a sufficiently rich palette and, like a painter who mixes his colors, he can produce the most varied shades; all that is necessary is for him to have a little familiarity with and an exact idea of the coloring power of the different metallic oxides.

The preliminary work of the U. S. Bureau of Standards on the investigation of the drying properties of clays has been completed and a report is now being prepared for publication.

On Devitrification Phenomena in Practice in Glass Factory Operation*

By Hugo Knoblauch

(Continued from November Issue)

The opportunity is offered here of making observations on further characteristics of devitrifications. Thus we differentiate between the tendency towards crystallization or the spontaneous ability to crystallize, and the rate of crystallization. The tendency towards crystallization or the effort of the glass, from which crystallization nuclei can form, manifests itself at considerably lower degrees of temperature than the rate of crystallization which restricts the further growth of the crystal heaps. If therefore a glass has a great tendency to separate out crystal nuclei, it will separate out a great many of such nuclei on slow cooling which however, because the temperature has sunk too low, or on account of the too far advanced stiffness of the mass, could no longer unite for larger formations. Such a process is shown in Figs. 7, 8 and 9, which represent devitrified white glass. Fig. 7 shows an apparatus-glass from Thuringia and Fig. 9 a devitrified white glass in a tank from the Lausitz

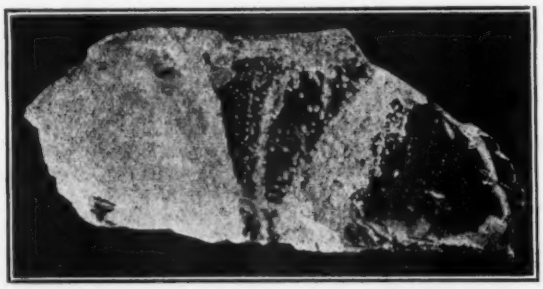

FIG. 7

industrial region. In Fig. 8 the left sample gives a clue for explaining the matter. It treats of a white glass melted in pots which was caught as hearth glass (glass which has flowed onto the hearth) in a cold glass pocket. The sample therefore is formed by the flowing together of strands of glass. Within the glass pocket during the time of the running down the glass strands experienced certain temperature fluctuations within the devitrification limit and there could form infinitely many crystal nuclei which led to rendering the mass turbid. It is pointed out intentionally that at the time no milk glass or opal glass was melted in the furnace and that it is a case here of a sample of ordinary white glass. The sample on the right in Fig. 8 shows white glass likewise melted in a pot and solidified in it. The surface of this sample turned forward shows the surface of the glass residue in which occurs the fact already mentioned above in the phenomena, that on the surface of the glass mass fine crystal segregations occur especially easily, which can become dense to a tangled felt-like crust because as it were a quantity of crystal nuclei in the form of flue dust particles seem to be implanted on the glass by which further crystallization is favored.

*Sprechsaal, Vol. 57. May 23, 1924. Translated for THE GLASS INDUSTRY.

In Fig. 10 are shown two pieces which represent certain devitrification stages in the preparation of glass. The larger piece is a fragment of a boiling flask of Bohemian apparatus glass, while the smaller is a fragment of an ornamental glass which was clouded intentionally in order to attain a certain decorative effect.

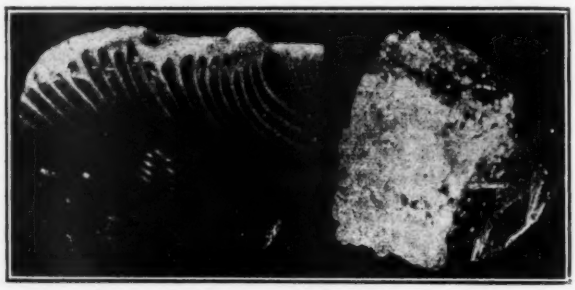

FIG. 8

It is a case here of a slightly clouded opal glass, in which the various clouding has been introduced by heating the glass differently corresponding to the pattern. We first blow a glass ball from the slightly opalized glass mass and then while still very hot it is put in a sharply and deeply engraved mold. In this manner the glass walls are blown out unequally corresponding to the engraving and also undergo a non-uniform cooling corresponding to the engraving. By this different temperature within the glass mass we also get the peculiar segregations or cloudiness. So at least on the

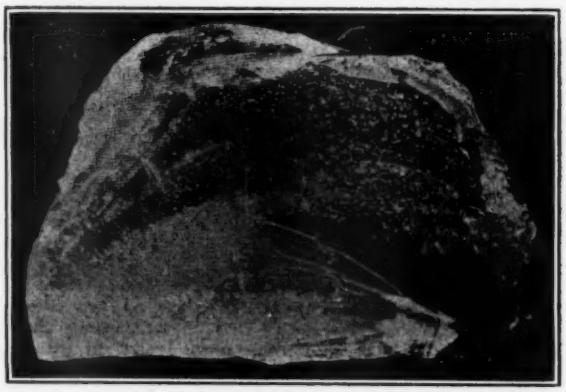

FIG. 9

basis of what is known about devitrification phenomena one could explain this process although there is also room for other assumptions.

Thus the most frequent opinions were to the effect that the clouding, especially if fluorine compounds were present among the constituents of the mix also, could be caused by the fact that in the stage of the slow cooling, fluorine vapors escape from the mass, which in the effort to become free permeate the mass with an infinitely great number of very

small bubbles. This opinion gains in plausibility if it is remembered that fluorine glasses, i.e., on working, especially when they are still very hot, eject sour tasting gases, to which doubtless can be traced back the stirring up of fluorine glasses at great heats in which the glass completely loses its property of becoming turbid. In any case, however, glasses melted with calcium fluoride and feldspar or cryolite show a very strong tendency to devitrify, as a matter of fact much more than all other glass fluxes of commerce, for one must either work the opal glass very much hotter than ordinary glass or if opal glass is melted in individual pots in a furnace at the same time with other glasses, all the opal glass must be worked out first because it does not reach the steady lower working temperature without devitrifying.

In the course of these observations the assumption was already touched upon that under the conditions most favorable for the devitrification individual constituents of the glass can also separate out. If we wish to establish the fact that under the conditions described above the glass mass as such can go over completely into the crystal condition there are doubtless many arguments that individual constituents or, better said, materials produced from the mass under the conditions that prevail during devitrification phenomena can separate out.

Figure 11 is one proof of this. This is a piece of rolled crude glass from whose photograph it can be seen that the side turned to the observer which rested on the rolling bench, is permeated with clouded spots. In this connection it must

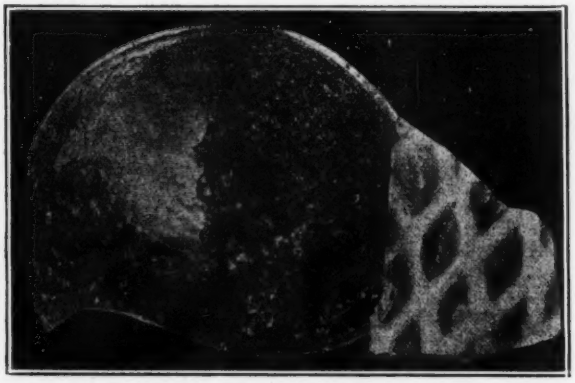

FIG. 10

be remarked that the glass on rolling and pressing takes on a swollen hammered appearance on the surface. The latter is therefore uneven and the bright spots in the picture indicate the places where the bench showed slight elevations. After placing the sheet in the annealing furnace the glass mass with these elevations comes into contact with the hot bottom of the annealing furnace. The heat taken from the bricks of the annealing furnace floor may favor, in the places where the sheet is in direct contact with the bricks, the occurrence of certain segregations, but naturally only when it is a glass that contains certain substances dissolved in it. With ordinary cast mirror glass whose composition corresponds to about that of the sheet glass in the first three figures, at most however, somewhat richer in lime and silicic acid, no segregations occur under the ordinary annealing temperatures. On the contrary it shows that with clouded cast glasses, corresponding to the spots in Fig. 11, fine, rough complexities appeared in the mass, the latter being permeated as a result of crystallization, with infinitely many very fine lines throughout the crystal structure, so that the polish of the glasses at these parts seems somewhat weak. However, glasses that were colored black with carbon and sulphur showed brighter colors at exactly the same spots; here probably under the influence of air from the hotter parts, oxi-

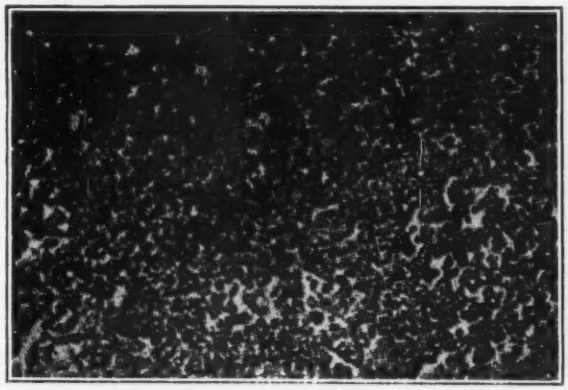

FIG. 11

dation took place the result of which reduced the black coloring. Actually it is here not a case of a devitrification but of an interesting phenomenon which, on account of its great similarity to that might lead one astray.

With sample 11 it is a mixture that was determined for opal glass. Through error, however, Glauber's salt instead of cryolite was introduced. The glass therefore contained sand, soda, some red lead and Glauber's salt instead of cryolite. After cooling, the rolled mass showed the spots seen in the picture only on the side next the rolling bench. The glass which, on account of its excess soda content naturally could not be used, seems therefore to have separated out the Glauber's salt dissolved in it.

(*To be continued*)

Evaluating the Different Qualities of Clays

The elementary chemical analyses of all clays show the same constituents, but in widely varying proportions. These differences have failed to account for variations in color (raw and burned), working properties, plasticity, absorption, adhesiveness, and refractoriness.

The Bureau of Standards has undertaken the study of clay colloids, into which a part of all the ultimate elements of the clay body enter, by subjecting a standard, commercial, washed white paper and pottery clay, long known for relative uniformity in its properties, to the action of leaching and dispersion with water and dilute reagents to which it may be subjected in its various uses. It has been separated into fractions of relatively greater and less concentration of absorbed basic elements, and into fractions of greater and less colloid content, and of coarser and finer granular composition. These divisions are to be subjected to all practical tests capable of quantitative evaluation in comparison with the original.—*Technical News Bulletin, No.* 91, *Bureau of Standards.*

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Solving the Coal Problem

The Coal Storage Committee of the American Engineering Council has recently issued a complete report comprising over 100,000 words, concerning the advisability of coal storage by consumers. That this report deserves the attention of the glass industry is obvious. If the definite recommendations made by the committee are acted upon by the majority of consumers of bituminous coal it is certain that existing conditions will greatly improve.

It is asserted that coal will be more plentiful and lower in price if storage is made a general practice by consumers who, according to the findings of the committee, have it in their own hands to remedy the present coal situation.

The main committee is headed by W. L. Abbott of Chicago, working in co-operation with the United States Coal Commission, the Bureau of Mines, the Geological Survey and the Department of Commerce. More than four hundred engineers in all parts of the country have collaborated in this important survey.

The interesting fact is disclosed that storage of only nine to ten per cent of the annual requirement is all that is necessary to relieve the distressing conditions prevailing at frequent intervals. It is pointed out that if an additional reserve storage of about seven per cent is added, there will result an accumulation of about 83 million tons of coal in storage by September 30th of each year.

The following is a summary of the outstanding conclusions and recommendations of the committee:

"The storage of coal is necessary as an aid to the solution of the national coal problem, and is an economic and practicable means of insuring an adequate supply of coal as needed.

"If each coal consumer will adopt the policy of annually purchasing coal on a uniform monthly delivery basis, there will result automatically sufficient seasonal storage to guarantee coal to the consumer as needed. Furthermore, this policy will bring about a uniform demand for coal whereby coal producers and carriers may establish uniform and standard production and shipment schedules. It will also remove the evils of intermittent operation of coal mines, frequently panicky market conditions and coal shortages due to inability of the carriers to meet peak demands.

"Equipment has been developed and may be secured to meet any storage situation or requirement. The cost of such equipment may be as little as a few cents per ton of capacity.

"Storage of coal presents no serious risk of loss from breakage, spontaneous combustion, or loss of heat value or firing qualities. All kinds of coal have been and may be successfully stored.

"The cost of storage per ton, including fixed charges on equipment, maintenance and operation expense and interest on investment in coal as well as taxes and insurance in most instances is from $.50 to $.75 per ton yearly for large storage plants and from $1 to $1.50 per ton yearly for small plants storing from a few hundred to a few thousand tons.

"Storing of coal may be easily financed. Banks will finance such an investment as readily as any other commercial undertaking.

"The transportation facilities of the United States are adequate for normal and regular movement of coal. For short periods the railways can move coal at an abnormal rate but this is both expensive and detrimental to shipment of the commodities and to normal freight movement.

"To increase transportation facilities to meet the peak demands resulting from the prevailing unsystematic practice in coal shipment would require an additional investment of some $12,000,000,000. Such an investment is not justified.

"In general, storage should take place at the point of use, to accomplish the most in relieving transportation and safe-

guarding supply. However, under some circumstances, storage at an intermediate point is advisable.

"Contracts for coal should be observed with fidelity. The evil practice of indiscriminate breaking of coal contracts has seriously injured the American coal industry with reference alike to production, transportation and consumption. Contracts for coal should be observed with the same good faith as universally prevails in regard to other forms of commercial contracts.

"Confirmation of the practicability of coal storage is afforded by the anthracite coal industry. This industry is far more stable than the bituminous, because producers, carriers and consumers of anthracite coal for a number of years have alike encouraged and practiced storage."

The committee urges that all coal consumers purchase their coal on an annual contract for yearly requirements with a provision that the coal be delivered in equal allotments, and that consumers provide necessary storage facilities to meet the terms of such contract.

"These recommendations," the report asserts, "are based upon the finding that the purchase of coal upon a uniform monthly delivery basis will result in a condition whereby;

"Coal mines may inaugurate and maintain a regular production schedule.

"Carriers may plan definitely as regards both schedules and equipment for a uniform movement of coal.

"Stocks of coal automatically will accumulate during the months from April to September inclusive in sufficient amount to meet the extra consumption during the winter months.

"A reduction in the price of coal will be made possible by more regular schedules of production and transportation and by elimination of peak demands in the winter months when the costs of both production and transportation are the highest."

Correspondence

The Proposed Ceramic Institute

Editor of THE GLASS INDUSTRY:

I was very glad indeed to read your November editorial. I see your point of view and understand, I believe, the reasons for it. I believe, however, that you have not visioned it sufficiently from the technical research standpoint.

I would like very much to prepare another statement on this and will do so at the earliest possible moment, sending you a copy.

I have not had in mind, and I question if anyone else has, of a research director who would have the experience and knowledge sufficient to handle the detail problems in all branches of ceramics. He could be nothing other than a technical director of the same sort that the Director of the Bureau of Mines or the Bureau of Standards is. The director of these two bureaus must of necessity be technical men of broad experience and with wide vision.

You are absolutely right when you say that the research work of the glass manufacturers must be handled by men trained in the problems of the glass business and in the same way the research work for the enamel manufacturers must be in the hands of one who understands the enamel problem, but there should be a unit head and joint library and editing facilities.

I hope that you will continue your thinking and your writing until we will have secured the attention of the manufacturers to this very important project.

ROSS C. PURDY,
General Secretary, American Ceramic Society.

Columbus, O., Nov. 12, 1924.

Gas Producer Test Code

The new Test Code for Gas Producers formulated by the American Society of Mechanical Engineers has been circulated for criticism and will be offered for discussion at a public hearing to be held on Tuesday, December 2, at 2:00 p. m., in connection with the society's annual convention in New York. The code was printed in full in December issue of the society's journal, *Mechanical Engineering*.

Technical Consultation Service

Question 63.—White flint glass food containers. Will you kindly advise me your opinion of the following formula for the manufacture of a pressed food container to be made of white flint glass; the tank to be used is a forty ton tank, oil fired, and the glass drawn by automatic feeders. A pure dry sand is used. The formula is:

Sand	1,175 lbs.
Dense soda ash	430 to 450 lbs.
Lime (Uncertain whether hydrated or burnt)	110 lbs.
Selenium	3 ozs.
Arsenic	1 to 1½ lbs.

If you do not think well of this formula will you please give me one or two formulae that you are confident will produce good results for the furnace indicated above.

Answer.—Assuming that 440 lbs. of soda ash and 110 lbs. of burnt lime are used, the composition of the glass, calculated from the formula given, is as follows:

	Per Cent
Silica (SiO_2)	76.19
Sodium oxide (Na_2O)	16.67
Lime (CaO)	7.14
Total	100.00

It should be understood that the calculated analysis is of course only an approximation, since there are undoubtedly some impurities in the sand and lime.

As long as the furnace in which this batch is melted is operated correctly there probably will be no difficulty in using the formula which you gave us. However, the silica content of the glass produced is very near the saturation point and it is our opinion that this batch will prove to be very sensitive to fire conditions. Even with the best supervision cold tanks will occassionally happen. For this reason we would suggest a batch slightly lower in sand and somewhat higher in soda ash and lime, as follows:

Sand	1,000 lbs.
Soda ash	386 lbs.
Lime (Burnt)	186 lbs.
Batch	1,572 lbs.

This batch will produce 1,330 lbs. of glass of approximately the following composition:

	Per Cent
Silica (SiO_2)	75.19
Sodium oxide (Na_2O)	16.98
Lime (CaO)	7.83
Total	100.00

The selenium and arsenic should remain unchanged. However, we cannot give any opinion as to the amount of selenium to be used since this depends entirely on the iron content of the raw materials.—J. B. K.

New Books

CHEMICAL ENGINEERING CATALOG. 9th Annual Edition. Published at New York by the Chemical Catalog Company, Inc., under the supervision of a committee appointed by the American Institute of Chemical Engineers, the American Chemical Society and the Society of Chemical Industry. 9 x 12 inches. 1,110 pages. Leased at $2.00 per copy per year to certain classifications of those interested in chemicals and chemical industries, $10 to others.

A large section of the book (284 pages) consists of a directory of manufacturers and "first-hand" sources of supply of chemicals of all kinds, raw materials, chemical equipment, etc. Over 700 pages are filled with catalogs and specifications of the products of manufacturers who serve the chemical industries. This is followed by a 115-page catalog of technical and scientific books obtainable from the Chemical Catalog Company.

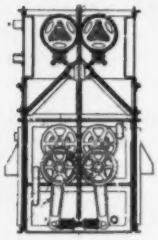
Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Copies of United States Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

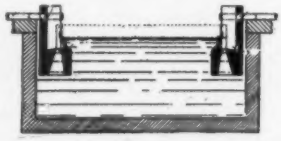
Lehr. U. S. 1,514,385. Nov. 4, 1924. Halbert K. Hitchcock, of Pittsburgh, Pa., assignor of one-half to Hitchcock Experiment Company. (App. filed Aug. 9, 1921. Ser. No. 490,836.)

The inventor claims in combination in a lehr for annealing a glass sheet drawn continuously from a molten bath, a vertical lehr casing having hollow walls, drawing means arranged along the length of the casing for engaging the glass and advancing it there through, transverse partitions arranged at intervals along the length of the casing dividing it into a plurality of compartments, the said partitions having slots to permit the passage of the glass sheet, heating means for the hollow walls of each compartment and sheets of woven refractory material for closing the clearance spaces between the edges of the partitions at the slots and the glass. Other features and the annealing process also are patented.



Means for the Manufacture of Glass in Continuous Sheets. U. S. 1,515,174. Nov. 11, 1924. Eugene Rowart, of Auvelais, Belgium. (App. filed Apr. 26, 1922. Ser. No. 556,721.)

This invention relates to improved means for the manufacture of glass in continuous sheets by the drawing process. In order to prevent any shrinking of the sheet, due to the superficial tension of the glass, the edges of the sheet are separately produced, independently from the sheet properly so called. This invention consequently consists in means whereby two strips of glass, adapted to constitute the edges of the sheet, can be produced separately, the said strips uniting themselves with the sheet properly so called during the drawing up of this latter. Two hollow refractory pieces are immersed simultaneously at a suitable distance from each other according to the width of the glass sheet which is to be produced in a mass of molten glass. Each of the pieces is provided with a hole from which the molten glass is continuously ejected on account of the gradual immersion of the piece into the mass of glass and the two strips of glass issuing from the said holes are lifted or drawn up while in the middle portion of the mass of molten glass, between the said two pieces, the main part or body of the glass sheet is simultaneously lifted the said main part or body portion of the sheet uniting then with the two strips as soon as the said main part of body portion comes into contact with the lateral strips in suitable grooves provided in the opposite faces of the refractory pieces.



Glass. 1,510,521. Fred M. Locke, of Victor, N. Y.

The object of the invention is to produce a glass which has very high insulating quality with a very low coefficient of expansion and great stability.

The insulating quality is increased through the inclusion of boron material existing in the glass in the form of boron oxide, and the inventor finds that the addition of small amounts of some of the metals, preferably in the form of metal salts or compounds of barium, strontium, calcium, and magnesium, produces stability in the glass and lowers the melting point materially, thereby permitting economic manufacture, and he finds that a glass which is high in silica and boric oxide with a small amount of alumina and with small amounts of alkalies and some of the metal compounds or salts above-mentioned, produces a glass which has a very low coefficient of expansion, great stability and the highest insulating qualities. The above named metallic elements may be known as opacifying elements.

As a specific illustration of this invention, the inventor discloses and claims a glass of the following analysis:

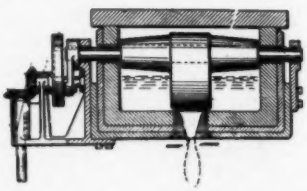
SiO_2 78.73%—CaO 1.33%—Al_2O_3 and FeO .86%—MgO traces—Na_2O 4.24%—K_2O .62%—Mn traces—B_2O_3 14.22%.

Such a glass is highly efficient for the purpose described and is peculiarly adapted for high voltage currents and high frequency.

The expansion coefficient of the above glass is approximately .0000032.

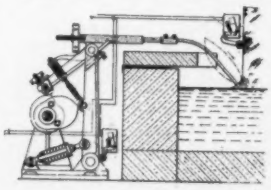
Glass Feeder. U. S. 1,512,373. Oct. 21, 1924. Leonard D. Soubier, of Toledo, O., assignor to the Owens Bottle Company, of Toledo, O. (App. filed Apr. 6, 1922. Ser. No. 549,978.)

The invention relates to the combination of a container for molten glass having a discharge opening extending through the floor thereof, a regulator projecting downward in the glass directly over the opening, and means to oscillate said regulator about a horizontal axis and cause it to swing from and toward said opening and thereby exert an alternate retarding and expelling force on the glass issuing through said opening.



Edge-Holding Device for Sheet Glass. U. S. 1,514,338. Nov. 4, 1924. Joseph H. Redshaw, of Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company. (App. filed Sept. 11, 1923. Ser. No. 662,057.)

The combination with apparatus for drawing a sheet of glass from a molten bath, of means for preventing the inward movement of the edge of the sheet comprising a pair of fingers spaced apart to receive the edge of the sheet, and driving means including an electric motor for moving the fingers at intervals downward into the glass bath and outward, a device comprising a member yieldingly pressed against the edge of the sheet and a switch operable therefrom for governing the supply of current to said motor so that the motor is stopped when the edge moves out beyond a predetermined point, and is started when it moves in beyond a predetermined point, and means for preventing the stopping of the motor until said fingers are withdrawn from the glass bath.

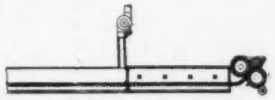


Method and Apparatus for the Manufacture of Glass Plates. U. S. 1,515,450. Nov. 11, 1924. Frank L. O. Wadsworth, of Pittsburgh, Pa. (App. filed Nov. 29, 1918. Ser. No. 264,569.)

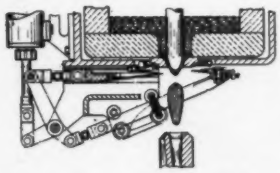
An object of this invention is to avoid various difficulties due to the thermal expansion and distortion of the table surfaces upon which plain or figured glass sheets are formed, difficulties which are particularly serious in the manufacture of ornametal or patterned sheets of glass—such, for example, as rolled sheet prism glass. This is accomplished by using a twin or "Janus" faced rolling table—which is mounted so that it can be readily reversed or inverted between successive rolling operations—and by alternately spreading the sheets of molten glass in opposite directions and on the opposite sides of the reversible table.

Process and Apparatus for Forming and Annealing Sheet Glass. U. S. 1,513,544. Oct. 28, 1924. Frederick Gelstharp, of Tarentum, Pennsylvania, assignor to Pittsburgh Plate Glass Company. (App. filed Jan. 23, 1922. Ser. No. 531,055.

A process of forming sheet glass which consists in rolling a molten mass of glass into a ribbon, feeding the ribbon while at a high temperature into a lehr divided into an annealing end and a cooling end, maintaining the glass flat in the lehr while advancing it therethrough, causing the glass to cool slowly from the temperature of setting to a temperature of approximately 950° F, and then applying artificial cooling means to the ribbon to hasten its cooling during the remainder of its progress through the lehr.



Glass-Cutting Apparatus. U. S. 1,512,412. Oct. 21, 1924. Enoch T. Ferngren, of Toledo, Ohio, assignor to the Owens Bottle Company, of Toledo, O. (App. filed Apr. 6, 1922. Ser. No. 549,999.)

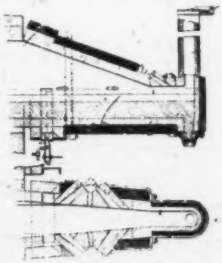


An object of the invention is to provide cutters which as they engage the glass will move it by their angle of penetration and displacement in a downward direction, this downward movement continuing also during the severing of the glass, thereby avoiding the arresting of the downward movement of the glass at or adjacent the cutting point.

A further object is to provide cutting means by which the gob or charge is severed from the issuing glass without pushing the upper end of the severed charge over to one side or out of line with the rest of the charge and without causing a tension or stretching of the upper end of the charge before the severance is completed. Cutting means as provided which during the severance of a charge reduce the diameter of the glass immediately above the cutters, or in other words, produce a tapered form to the cut surface of the stub remaining after the gob is severed.

Method and Apparatus for Delivering Viscous Glass. U. S. 1,512,566. Oct. 21, 1924. Oliver M. Tucker and William A. Reeves, of Columbus, O. (App. filed Aug. 12, 1918. Ser. No. 249,421.)

The object of the invention is to provide a spout which is thoroughly insulated and then equip it with means whereby the temperature of both the spout interior and the glass can be efficiently regulated.



The inventor claims in spout structure for delivering viscous glass the combination of a glass trough with a delivery opening therein, and channels extending upwardly through the spout walls adjacent the juncture of the spout with the furnace and opening into the interior of the spout above the glass line for the reception of a temperature modifying medium and the delivery of such medium into the interior of the spout above the glass, and means for introducing either a heating or a cooling fluid into said channels.

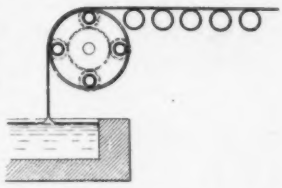
Glass and Composition Therefor. U. S. 1,513,923. Nov. 4, 1924. Robert J. Montgomery, of Rochester, N. Y., assignor to Bausch & Lomb Optical Company, of Rochester, N. Y. (App. filed Apr. 2, 1923. Ser. No. 629,424.)

Manufacturers of dense barium crown glass containing not less than 30 per cent barium oxide have frequently stated in their catalogs that this type of glass cannot be made free from bubbles. The inventor claims to have discovered, however, that the addition of antimony oxide to glasses of this type greatly improves the quality in respect to bubbles and also, antimony oxide can be used to advantage in control of the index of refraction and dispersion not to exceed 3 per cent.

Several glass compositions are given as examples of the glasses referred to and the quantities of antimony which will accomplish the results mentioned.

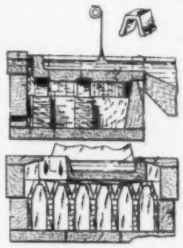
Apparatus for Making Continuous Sheet Glass. U. S. 1,514,953. Nov. 11, 1924. Joseph P. Crowley, of Toledo, O., assignor to the Libbey-Owens Sheet Glass Company, of Toledo, O. (App. filed Mar. 24, 1919. Ser. No. 284,708.)

In an apparatus for drawing continuous sheet glass, a bending device for the sheet, comprising a tubular metal roller, and supports rotating on fixed axes and engaging the inner surface of the tube at spaced intervals, so that large portions of the ends of the roller are always open and never occupied by any rotating parts, whereby non-rotary cooling devices may be inserted and applied locally to the interior of the tube.



Sheet-Glass-Drawing Furnace. U. S. 1,515,021. Nov. 11, 1924. Enoch T. Ferngren, of Toledo, O., assignor to the Libbey-Owens Sheet Glass Company, of Toledo, O. (App. filed Oct. 11, 1922. Ser. No. 593,885.

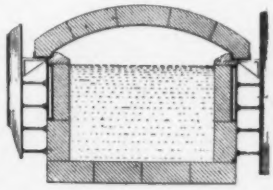
The object of the invention is to avoid unequal heating of the molten glass within the drawing pot of sheet glass drawing machines and the consequent inequalities in the glass sheet.



It includes the method of supporting above a heating chamber, the pot or receptacle from which sheet glass is drawn, consisting in providing a greater thickness of heat-absorbing material between the pot and the relatively hotter portions of the chamber and allowing free contact of the heated gases with the bottom of the pot above the relatively cooler portions of the chamber.

Water-Cooled Glass-Tank Furnace. U. S. 1,514,307. Nov. 4, 1924. Arno Shuman, of Philadelphia, Pa., assignor to Pennsylvania Wire Glass Company, of Philadelphia, Pa. (App. filed Jan. 28, 1920. Ser. No. 354,554.

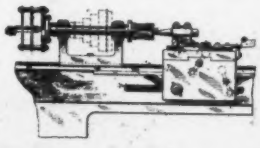
The principal object is to prevent tuck stones from falling into the tank.



The inventor claims in a water cooled glass tank furnace the combination of a side wall provided at its top with an external cavity, a water cooled box arranged in the cavity and having its top flush with the top of the side wall, a roof spaced from the side wall, and a stone extending from the inner face of the tank between the top of the box and roof and stopping the space.

Device for Making Glass Molds and the Like. U. S. 1,515,347. Nov. 11, 1924. Peter Kucera, of South Connellsville, Pa., assignor to Capstan Glass Company, of Connellsville, Pa. (App. filed June 25, 1921. Ser. No. 480,340.)

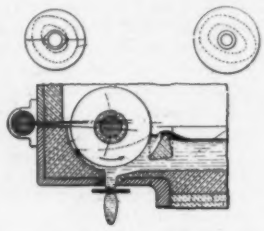
A mechanism for automatically forming molds having configurated walls.



The inventor claims in a machine for shaping molds for glass machines or the like, a main shaft, a plurality of pattern plates having openings therein rotated by the main shaft, a forming tool, a templet cooperating with the tool, and having a curved face and extending into said openings, and means to draw the templet against the edges of the

pattern plate openings to determine the path of the forming tool whereby the pattern plates may be selectively effective to determine the operation of the cutting tool.

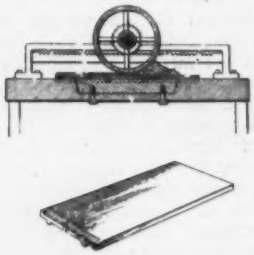
Apparatus for Separating Molten Glass into Mold Charges. U. S. 1,514,059. Nov. 4, 1924. William A. Lorenz, of Hartford, Connecticut, assignor to Hartford-Fairmont Company, of Canajoharie, N. Y. (App. filed May 3, 1922. Ser. No. 558,078.)



The inventor claims in an apparatus for segregating molten glass in mold charges, comprising a container having a submerged outlet, an impeller movable within the container toward and from the outlet to effect the periodic discharge of gathers therethrough varying in weight in a cyclic order, the impeller being also movable at intervals in a direction transverse to the outlet to reverse the glass therein, severing means for the gathers arranged to operate at or subsequent to the reversal periods, and means for effecting operation of the impeller and severing means in proper timed relation.

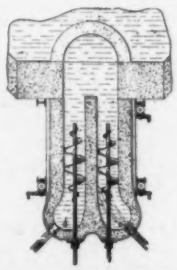
Glass-Rolling Pallet. U. S. 1,513,731. Nov. 4, 1924. Harry F. Anderson, of Marion, Ind. (App. filed Feb. 5, 1923. Ser. No. 617,129.)

In the art of glass rolling, when sheets of glass are rolled onto a pallet, they often creep upon the latter as the roller advances over the soft mass of glass. The object of this invention is to provide a glass rolling pallet having means at one end for holding the sheet against creeping. A portion of its surface is provided with an anchoring field to which the glass will cling when pressed into engagement therewith during the rolling operation.



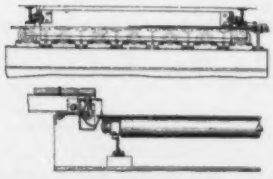
Automatic Glass-Feeding Machine. U. S. 1,512,383. Oct. 21, 1924. Thomas W. Warren, of Montreal, Que., Canada. (App. filed Oct. 23, 1920. Ser. No. 419,042.)

This invention relates to an automatic glass feeding device comprising a two channelled feeding element adapted to be aligned to an aperture in the wall of a tank of molten glass, a screw feed for drawing the glass through the said channels, means for reheating the glass in the feeding element, outlets to the channels, means for controlling the outlets independently, means for shearing the glass flowing from the said outlets, a receptacle for forming the sheared glass and means for discharging the glass from the forming means as described.

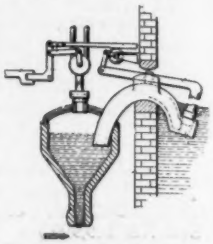


Apparatus for Inspecting Plate Glass. U. S. 1,514,386. Nov. 4, 1924. Harry F. Hitner, of Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company. (App. filed Mar. 27, 1924. Ser. No. 702,259.)

Apparatus for facilitating the work of inspecting a continuously forwardly moving sheet or ribbon of glass, comprising a table over which the glass passes of less width than the sheet so that the edges of the sheet project out past the sides of the table, a shielding compartment extending along each side of the table mounted for movement toward and from the longitudinal center line of the table and each having a slot in its side through which the edge of the sheet projects, illuminating means in the compartments adapted to project light laterally through the edges of the sheet, and means co-acting between the edge of the sheet and the compartments to regulate the position of the compartments.



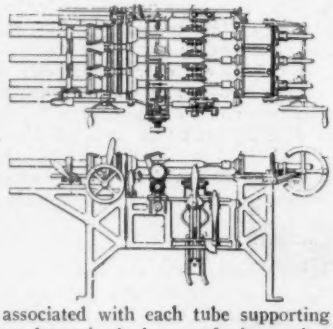
Method and Apparatus for Flowing Molten Glass. U. S. 1,514,091. Nov. 4, 1924. Clyde R. Lott, of Washington, D. C., assignor, by Mesne Assignments, to the Owens Bottle Company. (Original app. filed Sept. 27, 1909. Ser. No. 519,678.) Divided and this app. filed Mar. 15, 1920. Ser. No. 365,785.



This invention relates to a method which consists in siphoning molten glass from a pool into a closed container having a continuously open outlet below the level of the glass in the container, applying a periodic pressure to the glass in the container and thereby discharging pre-determined charges of glass through the outlet, causing the glass to be supported by atmospheric pressure at said opening and thereby preventing it from discharging when said periodic pressure is withdrawn, periodically interrupting the flow through the siphon in synchronism with said periodic pressure, and severing the charges from the glass issuing from the outlet.

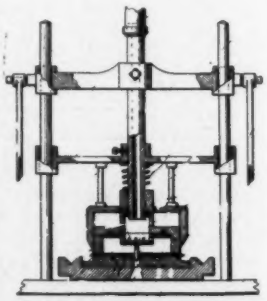
Multiple Glass-Blowing Machine. U. S. 1,511,889. Oct. 14, 1924. Alexander Kann, of Brooklyn, N. Y.

This invention relates to multiple glass blowing machines, and one of the principal objects is to provide a device of this nature whereby electric light bulbs, Christmas tree ornaments, and other like articles may be more readily, quickly, cheaply and conveniently blown.



The inventor claims, in a multiple glass blowing machine, a plurality of identical sets of revolving tube supporting mechanisms, means for heating the supported tube of each of said mechanisms, and blowing means operatively associated with each tube supporting mechanism for delivering a predetermined charge of air to the supported tube of such mechanism, said blowing means including a cylinder, a piston operating therein, and means for revolving the cylinder and the piston and for reciprocating the piston so as to blow air into the tube when the piston slides in one direction and for preventing the air

Glass-Blowing and Trimming Machine. U. S. 1,513,756. Nov. 4, 1924. Raymond F. Hancock, of Marion, Ind., assignor to James Boyce, of Gibson, Mich., and Harry F. Anderson, of Marion, Ind. (App. filed Jan. 29, 1923. Ser. No. 615,621.)



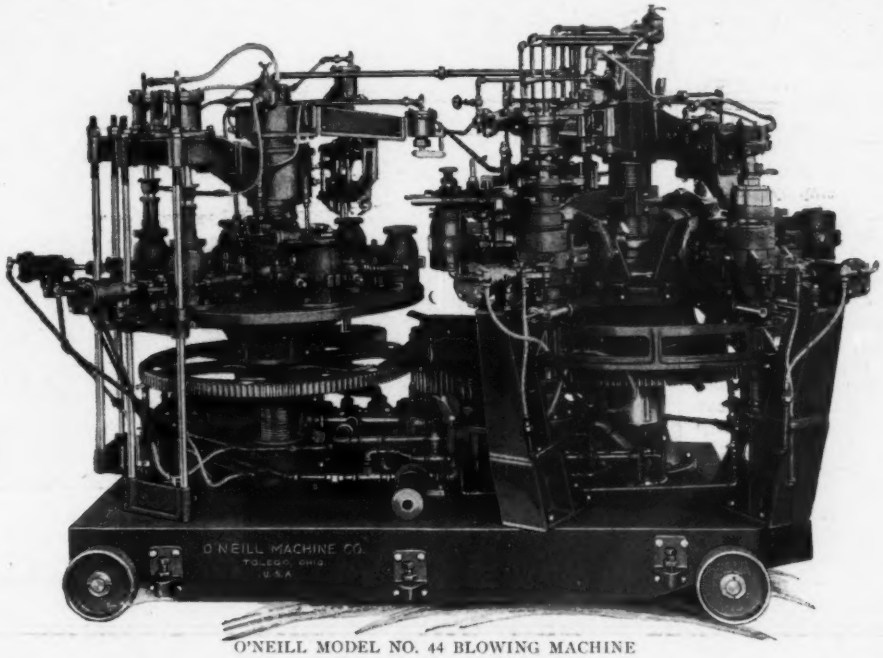
This invention relates to machines embodying a blow-head for application to a warm pliable sheet of glass for the purpose of blowing it into conformity with the shape of a die, one object of the invention being to provide a unique form of edge trimmer for the sheet of glass, which surrounds the blow-head. Another object is to provide unique means for successively moving the blow-head and the edge trimmer to operative positions. A further aim is to provide an arrangement of fluid pressure discharge orifices for the blow-head which will not direct the fluid pressure at any centralized point or points upon the glass sheet, but will equally distribute the pressure thereon.

Glass Factory Equipment and Supplies

THE GLASS INDUSTRY will be glad to publish descriptions of new and useful devices, machinery and supplies of interest to the glass manufacturing trade. Most of the information printed in this department comes direct from the manufacturers of the products described.

New Model O'Neill Machines

Users of automatic blowing machines will be interested to learn that during this year all standard model O'Neill blowing machines have been redesigned from the base upwards. The aim has been to produce machines which will require the minimum amount of the operator's attention, as well as to simplify the entire operation as much as possible.



O'NEILL MODEL NO. 44 BLOWING MACHINE

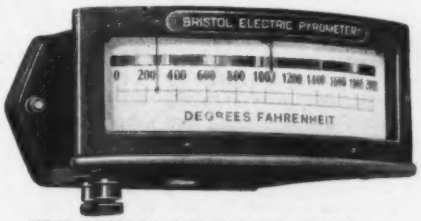
The first model to undergo complete redesigning was No. 28. This machine has been replaced by model No. 40. At the time of building machine No. 40, model No. 42 was also designed to meet the requirements of the soda water trade. This machine has eight blanks and eight blow molds and is especially well adapted to the manufacture of soft drink and other heavy bottles. The object of the eight blanks and eight blow molds is two-fold. It is not only to obtain greater production, but its greatest value lies in allowing heavy ware such as soft drink bottles to be made under conditions requiring the use of a minimum amount of cooling wind on the molds. The operation of molds without the use of wind for cooling tends to produce ware in which the glass distribution assumes its best form. Both of these models have a range from eight ounces to a gallon packer.

Model No. 25 which has been a standard for some years is now replaced by model No. 44. This machine has a speed up to twenty-two per minute and a range of six to forty-ounce ware. It has six blanks and six blow molds. The manufacturers state that trials under glass for a period well over three months have proved its value. Like the other new models it is a completely redesigned machine combining many new features and refinements. A feature of this new model is the arrangement for holding the blank mold and finish bushing together as a single unit, which has reduced to the minimum the wear on the blank and finish hinges. This arrangement has also been found to materially increase the life of finish rings. A system of replaceable table bushings, and bushing each wearing point with standard renewable bushings has met with great favor. The over-all height of this machine has been reduced and the columns increased in diameter. All of the various slide rods and pins on this machine are made of hardened steel ground to size. Levers and working parts are made of steel castings to insure more than sufficient strength.

The standard model No. 30 O'Neill machine will in the future be replaced by a new model, No. 48, which is a smaller appearing machine than No. 30, but much sturdier and with a range from one-half ounce to 8 ounces in capacity.

New Model Bristol Pyrometer

An important addition to their line of indicating high resistance pyrometers is announced by The Bristol Company, Waterbury, Conn., who state that their new model 420 for wall or switchboard use is an improvement over any of their previous models. It is provided with a wide open scale for easy reading even at a distance, while a knife blade section on the combination pointer makes it convenient for accurate close-up work.



NEW BRISTOL PYROMETER, MODEL 420

A high resistance Weston millivoltmeter is used for the measuring element. The usual cold-end error inherent in thermo-electric pyrometry is claimed to be absolutely and automatically eliminated by Bristol's patented automatic internal cold end com-

pensator. Because of it, the readings on the scale are accurate and no allowance for correction is necessary.

The instrument is enclosed in a cast aluminum dust-proof case. A small adjusting screw on the outside of the case provides an easy means of zero adjustment. A knob on the top of the case makes it possible to set the normal index spotter to temperature desired for each individual piece of work.

This pyrometer is furnished for all ranges of temperature up to 3,000 deg. F. Bulletins No. 330 and 1401-Bk describing model 420 and other Bristol pyrometer equipment may be obtained from the makers on request.

Strain Finder for Glass

The use of polariscopes for testing glassware for annealing defects has been adopted to some extent by glass manufacturers who aim to avoid the detrimental effects on their reputation that result from shipping poorly annealed products to their customers. Recently there has been noticeable also a tendency among large buyers of glass bottles and other ware to employ polariscopes for checking the quality of goods received by them from the manufacturer.

A recent development in apparatus for the determination and location of strains in glass, either thick or thin, is embodied in the polariscope here illustrated. With this instrument, it is claimed, strains occuring in glass due to incomplete or improper annealing may readily be detected in ordinary daylight without the aid of artificial illumination except when testing heavy glass. The device reveals strains in colored glass objects as well as in clear glass. It has a large optical field permitting observation of large bodies at a glance. Its optical properties are guaranteed. No refractive index solution is used and the apparatus, though of rigid construction, is light and easily moved from place to place. Its weight is slightly over 12½ pounds and it is 8 inches wide, 15 inches high and 24 inches long.

In designing the polariscope account was taken of the necessity of rapid operation. The construction permits the operator to pass the glass object into the apparatus with one hand and quickly and conveniently remove it with the other, greatly facilitating the testing operations.

Simplicity of construction keeps down the cost of manufacturing this device and permits the marketing of it at a moderate price. This polariscope was recently put on the market by the Industrial Apparatus & Instrument Company, 239 Springfield avenue, Newark, N. J.

METHOD OF OPERATING THE POLARISCOPE

The Glass World and What It Is Doing

News of the Industry

Plate Glass Production

Figures issued by P. A. Hughes, secretary of the Plate Glass Manufacturers of America, giving the production of plate glass of the United States during the third quarter of the year show a substantial decrease in the quantity produced as compared with the earlier periods of the year. The third quarter production was 17,733,174 square feet, compared with 21,777,789 square feet in the second quarter and 22,005,629 square feet in the first quarter.

Several causes contributed to the falling off of production. There was less demand from the automobile builders who normally consume practically half of the country's entire output of plate glass. There were large importations of plate glass from Belgium and other countries, and jobbers, pending the presidential election, failed to put in large stocks. The industry, as a whole, is now running considerably below production capacity. The outlook for the next few months is generally considered to be good for a fair volume of business.

Ford's Glassmere Plant Breaks Record

The Ford Motor Company announced in *Ford News* of November 8 that all production records of their Glassmere, Pa., plant were broken by the production of 733,000 square feet of glass in the 25 working days of September. This amount of finished, polished glass is the greatest ever produced in the same length of time by any similar factory in the world.

The capacity of this plant is regulated by 8 furnaces, each holding 16 pots, 52 inches in diameter, which makes a total of 128 pots cast daily. The pots remain 16 hours in full furnace heat, 2,600 degrees F., and the average amount of glass metal drawn from them ranges from 295 to 300 square feet each.

Marion G. Bryce Resigns as President

The resignation of Marion G. Bryce, as president of the United States Glass Company, Pittsburgh, Pa., became effective on October 29. He will continue as chairman of the board of directors. Mr. Bryce was succeeded by E. E. Slick, who was elected to the board of directors last year and who is widely known in the steel industry, having been connected therewith for many years. The officials of the United States Glass Company are now: Marion G. Bryce, chairman of the board; Edwin E. Slick, president; Reuben Haley, vice-president and general manager; Ernst Nickel, vice-president and treasurer; David Yost, vice-president, and William Nickel, secretary. In addition to the officers, the board of directors includes: James L. Challinor, L. Z. Birmingham, C. E. Willock, L. A. Meyran and H. N. Trimble.

The Glass Works of Chinwangtao to Start Operations*

The Chinwangtao Glass Company, a Belgian corporation, was organized on December 28, 1920, with a capitalization of four million francs, which was to be doubled by an equivalent amount of Chinese capital, for the purpose of introducing the mechanical manufacture of window glass by the Fourcault process into China. This arrangement has been replaced by another which is more advantageous: the organization of a Chinese company, the Yao Hua Mechanical Glass Company, with a capitalization of 1,200,000 Chinese dollars (8,500,000 francs), of which the Chinwangtao Glass Company subscribed half. The Belgian company gave to the affiliated company the license for use of the Fourcault process, received back the expense of organization and 600,000 dollars worth of stock in the Chinese corporation.

The capital of the Chinese company was increased twice, the Belgian company each time furnishing half of the increase. This explains why the capitalization of the Chinwangtao Glass Company was on March 12, 1923, Fcs. 6,500,000 and on April 26, 1924, Fcs. 12,000,000. With the Chinese share the total amount involved is 24,000,000 francs.

The Chinese company has assured itself through contracts the unlimited use of the coal mines of Kaiping, who are owners of the port of Chinwangtao. The glass factory is built near the harbor and near the coal storage of the mining company. The raw materials are abundant in the vicinity.

In the opinion of the European residents of China the glass works of Chinwangtao are the finest in Northern China. Houses for the Belgian directors, for the European foremen and for native workmen have been obtained.

A number of Chinese workmen, under the leadership of a Chinese engineer, Mr. King, visited the Fourcault glass works at Dampremy, to learn the operation of the machinery. These men are now available at the new factory. The necessary European personnel has also arrived.

The glass factory is under the direction of Mr. Olivier Gobbe, engineer-glass maker, from Jumet.

In view of the considerable quantity of window glass required by the Chinese market, there is little doubt but that this enterprise will have a brilliant future.

*From *Le Verre*, Vol. 4, No. 8 (August, 1924), p. 173. Translated for THE GLASS INDUSTRY.

The Lippincott Glass Company's Plans

The crown of the 20-pot furnace at the works of The Lippincott Glass Company, Alexandria, Ind., which was the largest glass pot furnace in existence, gave way about three weeks ago, and because of inherent defects in design it will not be rebuilt in its present shape. This furnace is one of the few oval furnaces in existence, the Libbey Glass Manufacturing Company, Toledo, O., also having one, but much smaller. It is manifestly difficult to retain a spring arch crown when not absolutely round as there are necessarily flat areas where the component of the two curves flattens out. Although this furnace has been used for twenty years, the fact that it has had a new crown each year is no argument, according to H. M. Anderson, vice-president of the company, for continuing a wrong design and is every argument for redesigning the furnace.

Mr. Anderson advises that reports that the company would discontinue the manufacture of pot glass and make only tank glass in the future are incorrect as a great deal of the ware produced is of such quality as to absolutely demand pot production and although it is planned to have six day tank melting units they will be for a certain part of the product only. Certain technical glasses, especially Lippincott Thermic heat-resisting glass, require higher melting temperatures than it has been possible to consistently obtain in pots. On the other hand it has been possible to obtain in tanks exceptionally good quality of glass at high temperatures and in a shorter melting period than is possible in pots.

The accident to the large pot furnace affected only a small number of the employes, the workers at the large furnace being thrown out of employment, but most of the company's five hundred employes continued right on at their work in the finishing, etching, cutting and decorating departments.

Glass Trade in the Irish Free State

The Irish Free State Government has this year commenced the publication of regular monthly import and export returns so that it is possible for the first time to gain some idea of the glass consuming capacity of the country. The appended table shows the imports during the seven months ending with July last, the dollar being reckoned at 4.50 to the pound sterling.

IMPORTS FIRST SEVEN MONTHS 1924

	Value
Illuminating Glass Ware	$ 43,672
Domestic and Fancy Glass Ware	157,536
Plate Glass	134,244
Sheet Glass	143,698
Bottles and Jars	330,844
Glass and Glassware U. E. S.	70,627
Total	$880,621

Although of the above total $635,305 is attributed to the United Kingdom, it does not follow that the goods are all of British manufacture, the official returns only taking cognizance of the ports of shipment. Of the balance of $245,318, $111,537 is credited to Belgium, $51,345 to Germany, $30,411 to Czecho-Slovakia and $51,525 to "other countries."

Glass Companies' Quarterly Reports

The quarterly financial report of the **Hazel-Atlas Glass Company** and subsidiary organizations for the three months period ending with September shows a net gain of $303,027. The net surplus as of September 27, 1924, was $1,981,370.

The report follows:

Total income after deducting for repairs and maintenance amounting to $191,028.14		$ 548,457.01
Less:		
Provision for general depreciation	$205,292.86	
Interest on bonds and borrowed money	40,136.82—	245,429.68
Net gain for three months		$ 303,027.33
SURPLUS		
Surplus at June 28, 1924		$1,905,079.10
Increase—Net gain for the three months ending September 27, 1924		303,027.33
		$2,208,106.43
Deduct:		
Quarterly dividend of 2% payable Oct. 1, 1924		226,736.00
Net surplus as of September 27, 1924		$1,981,370.43

Owens Bottle Company and subsidiaries for the quarter ended September 30, 1924, reported net profit of $853,005, after deducting expenses and Federal taxes, eqivalent after preferred dividends to $1.05 a share (par $25) earned on outstanding $16,512,750 common stock. This compares with $910,198, or $1.14 a share on common in third quarter of 1923. Net profit for nine months ended September 30 totaled $2,886,664, or $3.66 a share, on common after allowing for preferred dividends against $3,148,501, or $4.06 a share, in same period of 1923. Consolidated income account of Owens Bottle Company and subsidaries for quarter ended September 30, compares as follows:

	1924	1923
Manufacturers' profit	$1,397,006	$1,340,437
Other income	139,825	283,082
Total income	$1,536,831	$1,623,519
Expenses, etc.	567,326	590,221
Balance	$ 969,505	$1,033,298
Federal taxes	116,500	123,100
Net profit	$ 853,005	$ 910,198

The Standard Plate Glass Company shows an operating profit for the quarter ending September 30, 1924, of $219,093, before the deduction of special charges due to loss on dismantling for electrifying equipment and other improvements,

amounting to $32,383, shut down expenses due to changes of equipment $68,787, and inventory of adjustment at the branch warehouses due to price decline on plate glass and window glass, $104,681.

In addition to these special charges bond interest of $26,300 is charged against the third quarter's earnings. As all the bonds were called by October 1, 1924, there will be no further bond interest charges.

After deduction of the above special charges the deficit for the third quarter is $13,059. This loss was sustained in the first two months of the quarter, as the net profit for the month of September after all charges was $59,838.

At the annual meeting of the stockholders of the **American Window Glass Machine Company,** held in Pittsburgh, Pa., October 28, a report was made by President Monro, showing total income for the year ended August 31, 1924, of $1,464,568. In the year just ended the dividends on preferred capital stock were $489,965; on common capital stock, $1,299,830, with an addition to reserves of $150,000, making deductions of $1,939,795 from the total surplus of $2,640,201, leaving a surplus of $700,406 for 1924.

Plans for Glass Division at Convention

A large attendance is expected at the annual meeting of the American Ceramic Society at Columbus, O., February 16 to 21, inclusive. The first session of the Glass Division will be devoted to a symposium on glasshouse refractories in conjunction with the Refractories Division. Other details of the program will be issued later.

The following have been nominated for office to serve for one year: President, Edward W. Tillotson; vice-president, Frederick H. Rhead; treasurer, Herbert B. Henderson. For trustee of the Enamel Division, Ralph R. Danielson, and trustee for the Refractories Division, J. Spotts McDowell, both to serve three years.

Glass Association Meetings

Harry C. Sorden, secretary of the Mirror Manufacturers Association, again reminds members that the next national conference will be held on December 8, 9 and 10 at the William Penn Hotel, Pittsburgh. A business session will be held at 10:30 a. m. on Tuesday, the 9th. The association has been invited by the Plate Glass Manufacturers of America to a dinner on Tuesday evening and it is desired that every mirror manufacturer be present.

The National Glass Distributors' Association will hold their annual meeting at Pittsburgh, during the same period, December 9 and 10.

Trade Activities

It is reported from Barnesville, O., that the **Citizens Glass Company** has purchased the old Eastern Ohio glass factory at a cost of $28,000.

Newspaper reports state that **Alvin Larson** has acquired two tracts of land at Bristol, Pa., and will erect a plant for the manufacture of stained glass.

The Root Glass Company, Terre Haute, Ind., suffered a severe loss from fire on November 3, when glass house No. 3 was burned out and Nos. 1 and 2 were seriously damaged.

A letter has been received from **C. D. Kelkar,** Poona City, India, stating that he recently purchased the glass factory at Jubbulpore, Central Provinces, India, and will leave for there shortly to take charge of it.

Reports from Smethport, Pa., state that the **Saegar Glass Jar Corporation** has been successful in issuing bonds to the extent of $125,000 and that a large force of men has been put to work to complete the company's factory at Betula, Pa.

The Central Glass Company, Evansville, Ind., is having plans drawn for the rebuilding of its one-story mirror and glass works at 1900 State street, which was recently destroyed by fire. The new plant will be 100 x 200 ft. and will cost about $30,000. J. C. Zutt is manager.

F. W. Hodkin, B. Sc., A. I. C., late Senior Research Assistant in the Department of Glass Technology, the University, Sheffield, England, has accepted the post of manager of the glassworks belonging to The Edison Swan Electric Company, Ltd., Ponders End, Middlesex, England.

The Columbia plant of the **National Plate Glass Company,** at Blairsville, Pa., has resumed manufacturing operations after a lengthy shutdown for repairs and reconstruction work. The plant now consists of eight electrically driven grinding and polishing machines equipped with all necessary accessories.

Roland A. Wirfs, formerly president of R. A. Wirfs Refractories Company, has become associated with the **Keystone Refractories Company,** New York. Mr. Wirfs will be general sales manager for "Durastix" refractory cement in the Western district, with temporary office at 4609 McMillan avenue, St. Louis, Mo.

Dings Magnetic Separator Company, Milwaukee, Wis., announces the opening of an office at 229 Lovering avenue, Buffalo, N. Y., to handle sales of magnetic separators, in that territory. It is also announced that the Dings office at Birmingham, Ala., has been moved from the Brown-Marx building to 513 North 21st street.

The Austin Company of California, engineers and builders, announce the removal of their San Francisco office to greatly enlarged quarters at 244 Kearny street. Recently the headquarters staff of the company at Los Angeles moved into its new home at 777 East Washington street, a beautiful private office building, two stories high.

Fire caused by a bursted tank destroyed the factory of the **Salem Co-Operative Window Glass Co.,** Salem, W. Va., on November 10. The loss was estimated at over $100,000, only the warehouse being saved. Employes will all go to work for the **Alliance Window Glass Co.,** Salem, in whose tank fires were lighted on November 11th.

Reports came from Punxsutawney, Pa., in November to the effect that a **Window Glass Warehousing Syndicate** was being formed by the leading business men of the town for the purpose of guaranteeing the working expenses of the new Elk Run Window Glass Company for one year, in order to give the company an opportunity to get on its feet.

The J. E. Marsden Glass Works, Ambler, Pa., which was badly damaged by fire several months ago, has resumed operations after reconstruction and the installation of improved machinery which provides an enlarged production capacity. A 10 by 60 ft. Simplex flat arch muffle lehr, a duplicate of the lehr installed two years ago, has just been completed.

The McBride Glass Company, manufacturers of glass novelties, lamp globes, automobile lenses, etc., Anaheim, Cal., started construction on a new manufacturing unit early in November. The plant of the company was moved to Anaheim from Shreveport, La., at which time the first two units were erected and production was started the latter part of September.

The Campbell Window Glass Company has been organized by a group of local men of Grafton, W. Va., with O. S. Campbell as president, to operate the old Royal Window Glass Company plant at East Grafton. The company is capitalized at $200,000. The plant has been equipped with Hilton drawing machines and it is expected will be in operation in the near future.

The Capstan Glass Company, South Connellsville, Pa., met with a heavy loss on November 14 as a result of a leak which occurred in the bottom of a large tank. The firemen encountered considerable difficulty in fighting the fire on account of the steam which developed from ten streams of water which were continually thrown on the glass during the several hours that it was flowing from the break. It is estimated that it will take about sixty days to make necessary repairs to the tank.

The Combustion Engineering Corporation announces that James Cleary, formerly manager of their Philadelphia office, will assume management of the Detroit and Cleveland territories, with headquarters in Detroit. Frank Henderson will continue in charge of the Cleveland office and Joseph Lappin, formerly in charge of the Detroit office, has been assigned to New York for special work. The Detroit office has been moved from the Penobscot Building to the Book Building, Rooms 1142-1145, 1227 Washington Boulevard.

Decisions have been handed down by the United States Patent Office dismissing six interferences involving the broad idea of shaped suspended gob feeding, in which interferences patent applications belonging to the **Hartford-Empire Company,** Hartford, Conn., and **William J. Miller,** Swissvale, Pa., are involved. The motions for the dismissal of the interference were made on behalf of Mr. Miller by his patent counsel, Edward A. Lawrence, of Pittsburgh, Pa. These decisions are said to represent an important step in clarifying the feeder patent situation.

Butterworth Bros., Ltd., Newton Heath Glass Works, Manchester, England, recently announced that they had purchased the stock-in-trade, pots, molds, tools, cutting-shop and warehouse fittings and other accessories of Burtles, Tate, Ltd., Manchester, manufacturers of flint glass since 1858. Butterworth Bros. have also taken into their employment many of the glasshouse and warehouse staff and have undertaken the continuance of contracts for delivery of glassware of various kinds. Burtles, Tate, Ltd., have discontinued manufacturing operations and sold their factory property.

Work has been completed on the new $500,000 plant of the **Western Glass Company** at Fullerton, Cal., and is now in operation manufacturing wire-glass, skylights, prism and figured glass. The completed plant consists of 7 steel frame buildings and is the third production unit of the company, the main plant being located at Streator, Ill., and another factory at Shirley, Ind. When production has reached its capacity there will be about 175 men employed at the new plant and all of the departments will be in charge of men brought from the main plant at Streator. C. E. Ryan is president of the concern and C. H. Williams is vice-president. W. N. Rollo is western manager.

Industrial Publications

High Temperature Insulation. A 12-page pamphlet compiled by the Celite Products Company, Chicago, Ill., containing a lecture which will be delivered during the coming winter at many universities throughout the country. Attention is given to the factors affecting the quantity of heat lost, heat conductivity through walls, use of insulating materials, methods of determining rate of conduction through walls, advantages of insulation, etc.

Coming Meetings

The **Exposition of Inventions** will be held in the Engineering Societies Building, New York City, December 8 to 13.

The **American Ceramic Society** annual meeting will be held at Columbus, O., February 16 to 21, inclusive, 1925.

National Ornamental Glass Manufacturers' Association will hold its next annual convention in Pittsburgh, June 24 to 26, 1925.

The **Third National Exposition of Power and Mechanical Engineering** will be held at the Grand Central Palace, New York, December 1 to 6, 1924. The exposition will as usual parallel the meeting of the **American Society of Mechanical Engineers,** which will be held in the Engineering Societies Building, 29 West 39th street, New York.

National Glass Distributors' Association, annual meeting, Pittsburgh, December 9 and 10.

Mirror Manufacturers Association will hold its next national conference December 8, 9 and 10 at the William Penn Hotel, Pittsburgh, Pa.

Inquiries Received

For Further Information Address THE GLASS INDUSTRY.

233. We are desirous of communicating with manufacturers of perfumery bottles and candy jars, etc., colorless and of the better made type. (Nov. 5.)
234. I would like to procure some glass crystals 2¼ inches in diameter, with beveled edges. Also where can I have same printed or painted. (Nov. 12.)
235. Will you kindly inform us who are manufacturers of glasses known as Cathedral-Opaline-Florentinos? (Nov. 20.)
236. Kindly advise what concerns manufacture black glass cold cream jars. (Nov. 20.)

What the World Wants

Specific inquiries for American goods received in the Department of Commerce.

Numbers prefixed to the items refer to confidential information which may be obtained by concerns listed in the Exporters' Index by applying to the nearest district office of the Bureaus of Foreign and Domestic Commerce, or to headquarters at Washington, D. C. Mention the number of the inquiry in which you are interested.

To become listed on the Exporters' Index, it is necessary to fill out a form (Form 57), which may be had upon application to the Bureau or its district or cooperative offices.

Persia. 12037, glassware; 12044, glassware; 12256, glassware.
England. 12152, unbreakable windshields.
Norway. 12123, caustic soda and soda ash.
South Africa. 12284, cut glass.
Canada. 12316, soda ash.
Colombia. 12384, glassware.

Stock Quotations

(Reported by Moore, Leonard & Lynch, Pittsburgh, Pa.)

PITTSBURGH STOCK EXCHANGE, NOVEMBER 21, 1924

	Bid	Ask	Last
American Window Glass Machine, com..	85	85½	85
American Window Glass Machine, pfd..	94	95	94
American Window Glass, preferred.....	109	110	110
Pittsburgh Plate Glass.....	260	262	262
U. S. Glass.....	16	17	17
Standard Plate Glass, common.....	15⅝	15¾	15¾
Standard Plate Glass, preferred			
Cumulative	79	81	80
Prior	97	99	98

Glass stocks on the Pittsburgh Stock Exchange ruled considerably lower during the past month, but have recovered most of the ground lost. Demand continues heavy for American Window Glass Machine. Standard Plate in October sold down to a low of 13⅛ on the New York Stock Exchange, and has since become fairly steady at from 15 to 16. Increased demand for the glass stocks is but a reflection of the increased call for their products. Except for those wares which never move strongly, at this season of the year, demand for glass and glass products is excellent, except possibly for the cheaper grades and off qualities. There has been no great increase in the past month, but output now is probably 30% above that in early September. As for building glass, manufacturers believe that November will be the banner month of the year. Instead of having difficulty in giving orders, the producers have difficulties in filling orders as they would wish. The demand is for immediate delivery, in this as well as in table glassware. In spite of the heavy buying of building glass and the continued good construction movement, many distributors complain that profits are being annihilated by the intense competition. While there is price cutting among window glass manufacturers, the stocks available at reduced prices are generally inferior in quality and grading. Distributors, in order to get business, cut profits sharply early in the fall, and they have been unable to get back to a proper basis now that current demand is much better. Dodge building awards in 27 states in square feet, for October, 1924, were 47,489,800, compared with 43,452,700 in September, and 54,936,000 for October 1923. The 1913 monthly average was 31,250,000 square feet. This report shows a gain of 9 per cent over September, 1924, but a drop of 13% from October, 1923. The ten months record of all building, shows 509,421,800 square feet, against 497,060,000 square feet in the same months last year. Residential gained 9 per cent above the 1913 level.

WHEELING STOCK EXCHANGE, NOVEMBER 21, 1924

	Bid	Ask	Last
Hazel-Atlas	29	30	30
Imperial	75	88	88
Fostoria	140	...	140
Central	...	108	108

The Wheeling market for glass stocks is stronger and operations are about 70 per cent of capacity. The volume of new orders is more satisfactory. Hazel-Atlas, through its New York office, booked $5,000,000 more business in the first nine months of 1924, than in the corresponding period of 1923.

TOLEDO STOCK EXCHANGE, NOVEMBER 21, 1924

	Bid	Ask	Last
Owens Bottle Machine, common.....	41⅞	42⅛	42
Libbey-Owens Sheet Glass, common.....	104	108	106
Libbey-Owens Sheet Glass, pfd.....	108	110	...

Current Prices of Glass-Making Materials

Quotations furnished by various producers, manufacturers and dealers.

November 21, 1924	Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)...lb.	.05	.05½
Aluminum oxide (Al_2O_3).....lb.	.06½	.07
Antimony oxide (Sb_2O_3).....lb.	..	..
Arsenic trioxide (As_2O_3) (dense white), 99% .....lb.	.06½	.07
Barium carbonate ($BaCO_3$) (precipitated) .....ton	63.00	65.00
Barium hydrate ($Ba(OH)_2$).....lb.	.05	.05½
Bone ash .....lb.	.06	.06½
Borax ($Na_2B_4O_7 10H_2O$) .....lb.	.05	.05½
Borax, fused ($Na_2B_4O_7$) any mesh.lb.	.19	.20
Boric acid (B_2O_3), fused .....lb.	.35	.35
Cadmium Sulphide (CdS)—		
Red .....lb.	..	1.60
Orange .....lb.	1.50	1.60
Yellow .....lb.	..	1.80
Chrome Oxide (Cr_2O_3).....lb.	.35	.36
Cobalt Oxide (Co_2O_3)—		
In bbls. .....lb.	..	2.10
In 10 lb. tins.....lb.	..	2.20
Copper oxide—		
Red (Cu_2O) .....lb.	..	.19
Black (CuO) .....lb.	..	.25
Black prepared .....lb.	..	.30
Cryolite (Na_3AlF_6) .....lb.	..	.09⅛
Feldspar—		
100 mesh .....ton	14.00	16.00
80 mesh .....ton	12.00	..
40 mesh .....ton	12.00	..
Fluorspar (CaF_2)—		
Powdered white, 95%.....ton	38.00	..
Hydrofluoric acid (HF) 60% (in lead carboys) .....lb.	..	.13
Kaolin (f.o.b. mine) .....ton	9.00	12.00
Lead Oxide (Pb_3O_4) (red lead)...lb.	.11¾	.12
Litharge (PbO) .....lb.	.11¼	.11½
Lime—		
Hydrated ($Ca(OH)_2$) (in 50 lb. paper sacks).....ton	12.50	..
Burnt (CaO) ground, in bulk.ton	9.00	..
Burnt, ground, in paper sacks.ton	11.00	..
Burnt, ground, in 280 lb. bbls. per bbl.	2.15	2.30
Magnesium carbonate ($MgCO_3$)...lb.	..	.08
Manganese 85% (MnO_2).....lb.	.03¼	.03¾
Nickel oxide (Ni_2O_3), black, for nickel content .....lb.	.30	.30
Nickel monoxide (NiO), green, for nickel content.....lb.	.30	.30
Potassium carbonate—		
Calcined (K_2CO_3) 96%.....lb.	.05¾	.06
Hydrated 85%.....lb.	.05	.05¼
Potassium nitrate (KNO_3) (gran.).lb.	.06	.06¼
Potassium permanganate ($KMnO_4$) .....lb.	.14	.16
Powdered blue .....lb.	..	.24-26
Standard formula .....lb.	..	.32
Salt cake, glassmakers (Na_2SO_4), f.o.b. works .....ton	20.00-25.00	22.00-27.00
Selenium (Se) .....lb.	..	2.10-2.25
Soda ash (Na_2CO_3) dense, 58%— f. o. b. works.		
Bulk, spot.....Flat 100 lb.	1.40	..
Bulk, on contract....Flat 100 lb.	1.35	..
In 400 lb. bbls., on contract.100 lb.	1.69	2.40
In 400 lb. bags, on contract.100 lb.	1.45	2.16
Spot orders .05 per 100 lbs. higher.		
Sodium nitrate ($NaNO_3$),		
Refined (gran.) in bbls.....lb.	.04	.04½
95 per cent.....	.02⅔	.02½
Sodium selenite (Na_2SeO_3).....lb.	..	2.00
Sodium Fluosilicate (Na_2SiF_6)....lb.	..	.07½
Sulphur (S)—		
Flowers, 155 lb. bbl. Per 100 lb.	3.35	3.65-3.90
Flowers, in bags .....Per 100 lb.	3.00	3.30-3.55
Flour, heavy, in bbls..Per 100 lb.	2.40	2.85-3.05
Uranium oxide (UO_3), 100 lb. lots.lb.	..	1.25
Zinc oxide (ZnO).....lb.	.08	.08¼

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to October 23, 1924

	September 1923 Quantity	September 1923 Value	September 1924 Quantity	September 1924 Value	Nine Months Ending September 1923 Quantity	Nine Months Ending September 1923 Value	Nine Months Ending September 1924 Quantity	Nine Months Ending September 1924 Value
Glass and glass products (total).....	.....	$890,477	.....	$681,171	.....	$8,279,661	.....	$6,566,909
Plate and window glass—								
Window glass, common, box 50 sq. ft.....	2,574	12,661	1,394	8,411	34,403	186,233	28,830	131,644
Plate glass, unsilvered, sq. ft.....	166,748	78,488	73,328	31,710	1,691,139	713,467	1,398,427	414,015
Other windows and plate glass, n.e.s.....lbs.	196,174	27,783	181,082	15,110	2,756,318	314,498	1,592,814	168,113
Glass containers (bottles, vials and jars).....lbs.	6,167,709	269,880	4,542,278	207,021	56,573,393	2,687,220	45,712,462	2,160,909
Table glassware, plain.....lbs.	1,710,717	195,806	1,687,178	169,187	15,205,327	1,681,308	12,227,631	1,331,320
Table and other glassware, cut or engraved....lbs.	78,794	22,528	55,380	18,506	433,063	160,856	375,293	115,193
Glass for lighting—								
Lamp chimneys and lantern globes.....lbs.	181,679	28,995	111,398	21,163	1,490,694	290,918	1,500,877	279,067
Globes and shades for lighting fixtures.....lbs.	99,151	34,630	114,904	32,335	1,087,203	335,051	948,613	289,890
Lamps and other illuminating devices, chiefly of glass .....lbs.	99,604	31,227	63,272	20,074	1,159,242	297,653	762,357	221,032
Chemical glassware .....lbs.	20,834	14,524	25,157	21,814	170,158	123,644	168,204	139,932
Electrical glassware, except for lighting.....lbs.	344,546	16,629	82,058	19,047	2,205,893	140,877	1,911,120	192,136
Other glassware, n.e.s.....lbs.	914,797	157,326	611,995	116,793	7,754,241	1,347,936	6,755,621	1,123,658

IMPORTS

Corrected to October 23, 1924

Glass (total)	.....	2,194,358	.....	1,592,660	.....	18,198,635	.....	15,071,430
Cylinder, crown and sheet lbs.—								
Unpolished, lbs. .....dut.	3,339,300	137,301	1,873,748	104,661	38,782,633	1,683,705	25,017,058	1,433,977
Bent, ground, leveled, colored, painted, etc., and polished .....dut.	.....	47,882	.....	38,848	.....	607,753	.....	378,264
Plate glass—								
Unsilvered, sq. ft.....dut.	2,326,604	1,528,240	1,304,662	645,667	19,580,495	11,643,734	13,663,915	8,309,351
Fluted, rolled, etc., or silvered, or containing wire netting, sq. ft.....dut.	202,628	26,081	158,180	37,601	1,731,271	291,558	2,127,517	283,309
Containers—bottles, vials, etc.....dut.	.....	10,558	.....	13,977	.....	169,106	.....	156,417
Table and kitchen utensils, lbs.....dut.	84,705	13,151	105,719	28,438	342,650	97,989	691,609	149,618
Glassware, cut or decorated, lbs.....dut.	405,626	139,943	512,649	236,283	2,610,266	1,001,058	2,814,366	1,332,449
Blown glassware, n. e. s., lbs.....dut.	500,239	130,421	.....	.....	4,630,405	968,101	.....	.....
Bottles, ornaments, etc., lbs.....dut.	.....	.....	1,037,313	261,640	.....	.....	4,199,264	1,277,782
Bulbs or electric lamps, number.....dut.	.....	.....	539,188	6,332	.....	.....	10,681,739	170,962
Chimneys, globes, shades, etc., lbs.....dut.	.....	.....	527,883	105,826	.....	.....	3,554,387	644,505
Articles and utensils for chemical, scientific, and experimental purposes, lbs.....dut.	.....	.....	71,775	30,963	.....	.....	730,077	254,641
Other glassware .....{ free / dut.	.....	160,781	.....	82,424	.....	1,735,631	.....	680,155

DIXON CONTINUOUS TANK FURNACES

Dixon Tank Furnaces are constructed in accordance with the best glass factory practice. Every feature and detail has been proven practical, substantial and efficient. They are always built of the best material obtainable, by skilled workmen and are guaranteed to give entire satisfaction.

Repair work, remodeling, tank raising and all other work of this nature receives the same undivided attention as new work.

Our engineering department is at your service always.

H. L. DIXON COMPANY

"Everything for the Glasshouse"

P. O. Box 140 Pittsburgh, Pa.

Office and Works—Carnegie, Pa.

European Branch: King, Taudevin & Gregson, Ltd., Melbourne Chambers, Cambridge Street, Sheffield, England

HARTFORD-EMPIRE COMPANY

HARTFORD : - : CONNECTICUT

GLASS WORKING MACHINERY

LICENSORS OF

HARTFORD-FAIRMONT FEEDERS AND AUTOMATIC MACHINES

EMPIRE MACHINES : - : HOWARD FEEDERS

GLASS WORKING MACHINERY DEVELOPED FOR SPECIAL PURPOSES

CONSULTING ENGINEERS FOR MANUFACTURERS OF GLASSWARE

FOLLOW THE JUDGMENT OF THE MOST PARTICULAR
AND BUY

AMCO EQUIPMENT

HIGH DUTY TANKS FUEL OIL BURNING SYSTEMS
AMCO MUFFLE LEHRS GAS PRODUCERS
MATERIALS HANDLING AND STORAGE EQUIPMENT

THE AMSLER - MORTON COMPANY, Inc.
The Glass-House Engineers
Fulton Building Pittsburgh, Pa.

Quality Decides—

ALKALI

Wherever glass is made Diamond 58% Soda Ash is recognized for its superior quality.

ALKALI

"Diamond Tested" is more than a name. It is a guarantee of the highest quality.

Manufactured and Sold by
DIAMOND ALKALI COMPANY
PITTSBURGH, PENNA.

SOLVAY

STANDARD IN
SODA
SINCE 1881

Dustless
Dense Soda Ash
For Glassmakers

THE SOLVAY PROCESS CO.
Detroit, Mich. SYRACUSE, NEW YORK Hutchinson, Kan.

WING & EVANS, Inc., Sales Department
40 Rector Street New York
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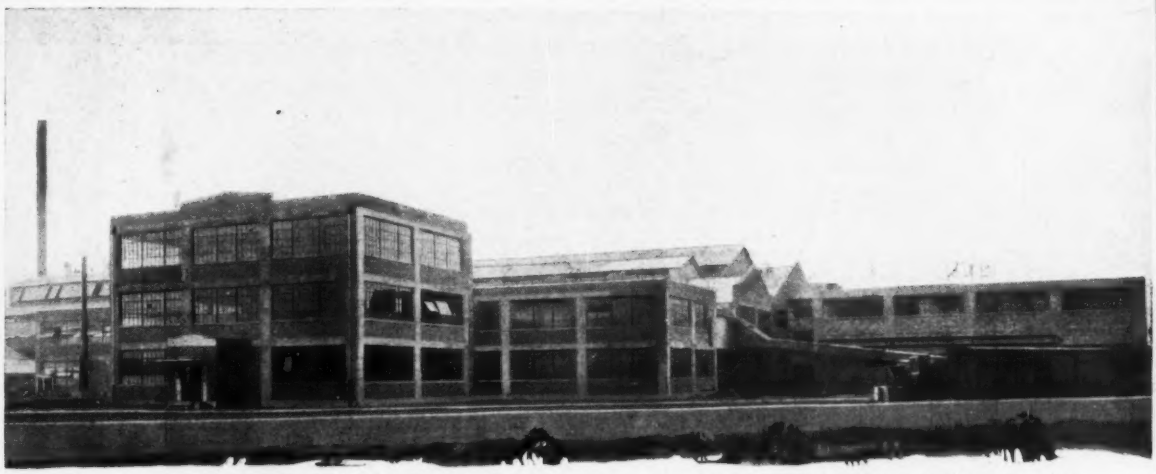
Chicago Syracuse Indianapolis



The Complete New Plant of The Hocking Glass Company at Lancaster, Ohio. Austin Unit Responsibility shouldered the whole load—Design, Construction and Equipment—and completed the job in Record Time.

Austin Delivers Complete Plant to Hocking Glass Company

A Partial List of Austin Clients

American Plate Glass Co.
Corning Glass Works.
Capstan Glass Co.
Dominion Glass Co.
Findlay Clay Pot Co.
H. C. Fry Glass Co.
*Hocking Glass Co.
Highland Glass Company
International Glass Co.
*Indiana Glass Works
Lancaster Glass Co.
Manufacture de Glaces de Maubeuge
*Maryland Glass Corp.
*National Lamp Works of the General Electric Co.
The O'Neill Machine Co.
*Pilkington Brothers, Ltd.
Pittsburgh Plate Glass Co.
Rhode Island Glass Works.
Southern Glass Co.
Technical Glass, Inc.
Travis Glass Co.
*Whitall Tatum Co.

*Indicates Repeat Contracts.

IN just 8 weeks after fire destroyed the plant of the Hocking Glass Company at Lancaster, Ohio, quick action on the part of The Austin Company enabled the owners to resume production.

In a little over six calendar months from the date of the fire the plant was delivered complete as shown in the illustration above.

Satisfaction with Austin Performance on the initial contract led the Hocking Glass Company to award to Austin the construction of several additional buildings—Administration Building, Enameling Building and a Large Warehouse, making this one of the most complete and efficient plants of its kind in the country.

Austin will build for you, under the Unit Responsibility Plan, giving you an ironclad guarantee as to lump-sum price, definite date of delivery, and as to quality of materials and workmanship. Under this plan Austin assumes the whole load of design, construction and equipment.

The Austin Method of building under the Unit Responsibility plan is fully explained in the booklet, "The A No. 1 Plan" which should be in the hands of every executive responsible for the successful operation of a glass plant. Wire, phone or mail the coupon for your copy of this booklet.

THE AUSTIN COMPANY, Cleveland

Engineers and Builders of Modern Glass Plants

NEW YORK	217 Broadway	CHICAGO	1300 Burnham Bldg.
CLEVELAND	16112 Euclid Ave.	DETROIT	2201 First Nat. Bank Bldg.
PITTSBURGH	493 Union Trust Bldg.	PHILADELPHIA	1220 Jefferson Bldg.
ST. LOUIS	1794 Arcade Bldg.	SEATTLE	880 Dexter Horton Bldg.
BIRMINGHAM	807 American Trust Bldg.	PORTLAND	516 Porter Bldg.

THE AUSTIN COMPANY OF TEXAS: Dallas, 627 Linz Bldg.
THE AUSTIN COMPANY OF CALIFORNIA: Los Angeles, 777 E. Washington St.
SAN FRANCISCO, 244 Kearney St.

THE AUSTIN METHOD

AUSTIN

ENGINEERING CONSTRUCTION EQUIPMENT

THE AUSTIN COMPANY,
CLEVELAND.

Please send me a copy of your booklet, "The A No. 1 Plan."

We are interested in the construction of a ..... building, width ..... length ....., description .....

.....

Firm .....

Individual .....

Address .....

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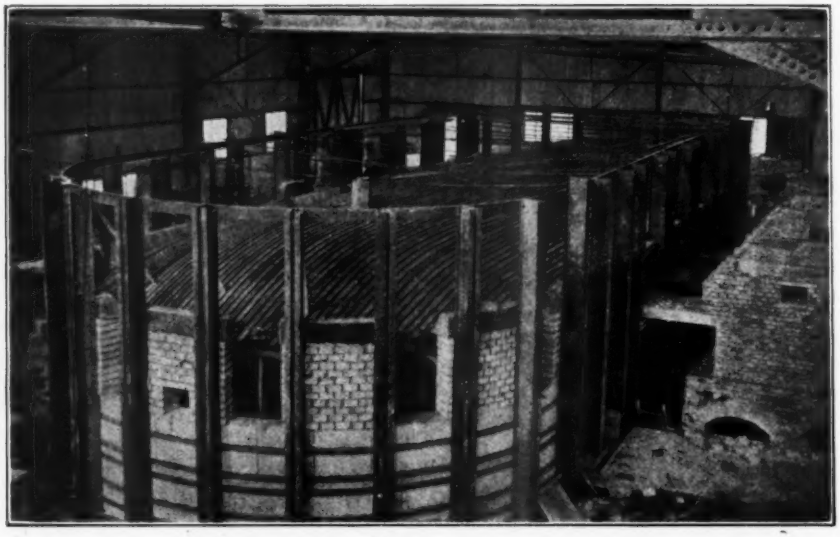
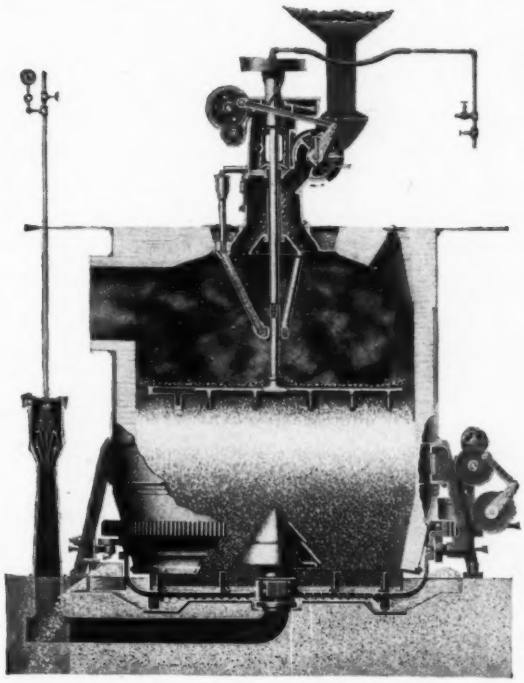


There is One Right Way to Build a Furnace

And that way is to entrust the design and construction to an organization of engineers who do nothing but design and build all types of industrial furnaces. Such an organization because of its experience can give you a furnace that will include the latest labor and fuel saving features. It can also give you better engineering, better construction and better materials for less cost. Our quotation on any type of industrial furnace will convince you that this is true.

Designing and construction engineers for every type of industrial furnace including Chapman-Stein Recuperators

The CHAPMAN-STEIN FURNACE CO.
C&G Division of The COOPER CO.
MT. VERNON, OHIO.
Since 1833 Engineers and Builders



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Doesn't it seem reasonable that you can rely upon the advice of an organization of technically trained engineers whose gas producer experience reaches back nearly a quarter of a century—an organization which does nothing but design gas producers and advise on complete producer gas installations? It is because so many have asked us to solve their producer gas problems both in this country and in Europe that we can point to over one thousand Chapman units installed during the past five years.

A Chapman full mechanical producer with every operation automatic and continuous is recommended where labor saving and efficiency of operation are dominant factors. Where it is more important to keep the investment low we furnish a lower priced semi-mechanical producer. Thus we are in position to recommend equipment to meet individual conditions.

A constantly expanding field of service has fitted us to give better and more up-to-date service on any gas producer problems.

The
CHAPMAN ENGINEERING CO.
C&G *Allied with The*
COOPER
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Since 1833 Engineers and Builders

"-they've even sent us *a design* for our new plant"

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We are prepared to offer you this same service, on a wholly impartial basis and without expense to you, if you are interested in this growing market of nine million prosperous people best reached from the San Francisco Bay District.

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Send me specific information about my opportunities in the San Francisco Bay Industrial District.

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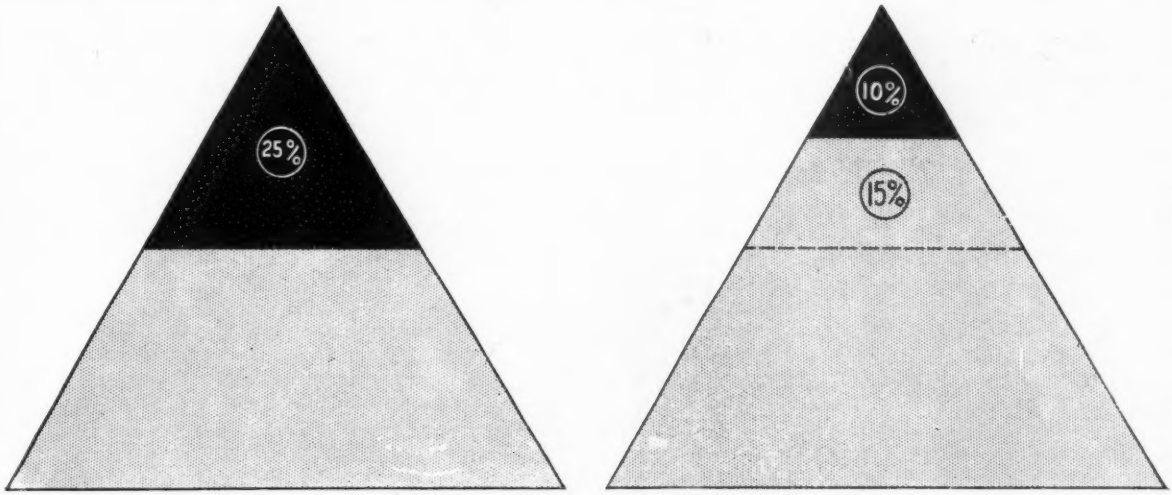


In Black and White

The black parts of the triangles represent the heat lost by conduction and radiation, (left) from an uninsulated lehr, and (right) from a lehr insulated with Nonpareil Brick—25% in one case, less than 10% in the other.

It is a true picture. Nonpareil Insulating Brick built into lehr walls and crowns reduce "radiation loss" by 60% to 70%. If you look at it only from the standpoint of fuel economy, a 15% saving is a considerable item. As an investment, it pays for the insulation in a very few months; after that it is clear profit.

But fuel saving is only one result of cutting down radiation loss. A lehr insulated with Nonpareil Brick heats in less time. It is more uniform in temperature. It does not have to be overheated in one place to insure a high enough temperature in another. It is cooler on the outside and more comfortable for the workmen. It is a better lehr that costs less to run.

The insulation of lehrs is treated in detail in the 72-page book "Nonpareil Insulating Brick," which will be mailed to you on request.

ARMSTRONG CORK & INSULATION COMPANY, 188 Twenty-fourth Street, Pittsburgh, Pa.

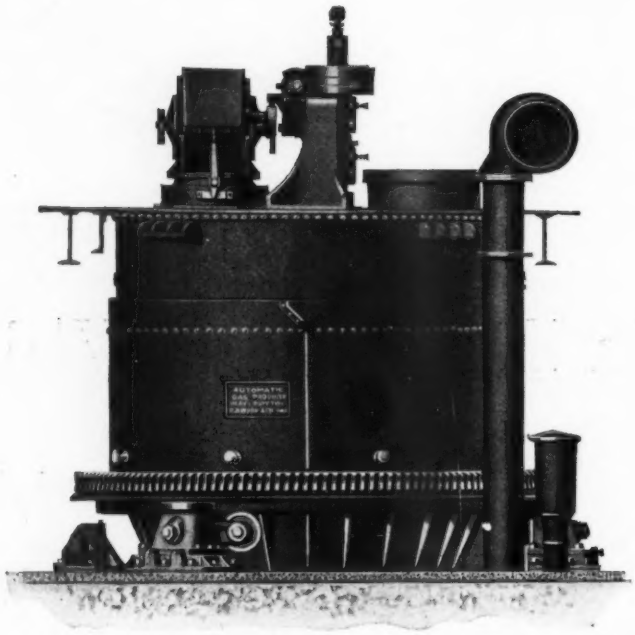
Also manufacturers of Nonpareil High Pressure Covering for steam lines, feed water heaters, boilers, etc.; Nonpareil Cork Covering for drinking water systems, brine and ammonia lines and cold pipes and tanks generally; Nonpareil Corkboard Insulation for cold storage and constant temperature rooms; Nonpareil Cork Machinery Isolation for noisy machines, and Linotile and Armstrong's Cork Tile for floors in offices, residences, etc.

Nonpareil Insulating Brick

For Lehrs, Producer Gas Mains and Boilers

WOOD AUTOMATIC GAS PRODUCERS

The Recognized Standard in the Glass Industry



The Wood Heavy Duty Gas Producer illustrated above is the result of twelve years' experience in the design, manufacture and operation of Automatic Gas Producers.

Every detail of the machine is built for

HEAVY DUTY AND CONTINUOUS SERVICE

and for this reason the cost of upkeep is considerably less than with any other mechanical gas producer. It is by far the most **RELIABLE** machine on the market.

Our catalog gives details. Mailed on request.

HYDRAULIC MACHINERY & OPERATING VALVES

R. D. WOOD & CO.

ESTABLISHED 1803

PHILADELPHIA, PA.

CAST IRON PIPE, HYDRANTS AND VALVES

Hermansen Furnaces Produce Better Glass

The flame travel in Hermansen Glass Melting Furnaces is continuous—no switching back and forth.

More even temperature results.

Quicker melting is secured.

Higher temperatures are maintained.

Less fuel is required.

All installations made by this organization are on a basis of guaranteed fuel consumption. Our engineers will gladly cooperate with you.

INDUSTRIAL FURNACE DEPARTMENT

Combustion Engineering Corporation

Combustion Engineering Bldg.—43 Broad Street New York City

Offices in Principal Cities Throughout the World

Frederick Multiple Retort Stokers
Type E Stokers
Type K Stokers
Type D Stokers
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Self-Contained Stokers

Combusco Water Seal Conveyors
Lopulco Pulverized Fuel Systems
Green Chain Grate Stokers
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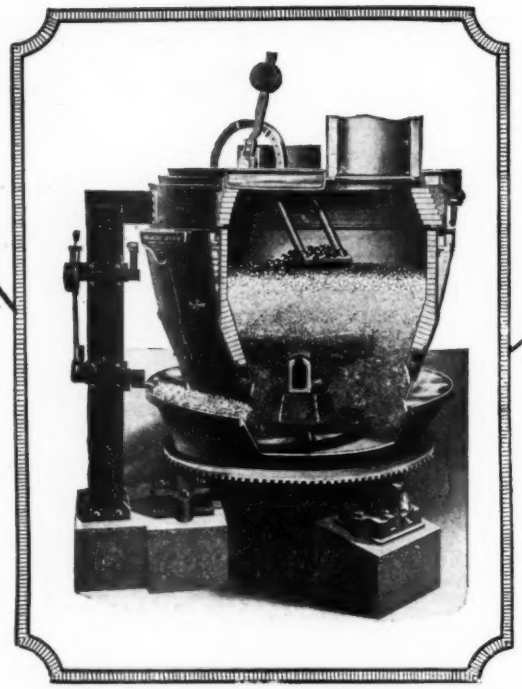
Coxe Stokers
Grieve Grates
Air Heaters

That Supreme Quality

Reliability

Out-valuing all others where, as in glass making, continuous operation without breakdown or delay is imperative.

ABSOLUTE RELIABILITY—the most important but not the only notable characteristic of



THE MORGAN
POKERLESS PRODUCER GAS MACHINE

—which in all respects measures up to the exacting requirements of the following progressive glass manufacturers:

Corning Glass Works	Corning, New York	8	Machines
Macbeth-Evans Glass Co.	Charleroi, Penn.	4	"
National Lamp Works	Cleveland, Ohio	6	"
National Plate Glass Co.	Ottawa, Illinois	13	"
Edward Ford Plate Glass Co.	Rossford, Ohio	8	"
Edison Lamps Works	Fort Wayne, Ind.	2	"
Hazel-Atlas Glass Co.	Grafton, W. Va.	2	"
Owens Bottle Co.	Fairmont, W. Va.	1	"
Foreign Glass Plants		13	"
	Total number installed in Glass Plants	57	Machines

Morgan Construction Company
Worcester Massachusetts

Pittsburgh Office: 610 Magee Building

MATHIESON Chemicals

A True Test of "Dustless" Soda Ash

THE non-dusting quality of Dense Soda Ash cannot be accurately judged by mere observation of its behavior upon unloading. Such conclusions are too largely dependent upon existing weather conditions, which are the most serious factor in creating a dust nuisance.

To provide a universal test by which a true comparison of non-dusting quality may be obtained, we submit our Dense Soda Ash to a standard screening analysis to determine the percentage of fine particles which will pass through a 200-mesh screen and may therefore be considered as dust. Before leaving our works, every car of Mathieson Dense Ash must measure up to our standard screening test.

Its exceptional freedom from dust and its uniform chemical and physical properties make "Eagle-Thistle" Dense Soda Ash particularly suited to the glassmaker's requirements.

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EAGLE THISTLE PRODUCTS

Deal Direct with the Manufacturer

Bicarbonate of Soda
Liquid Chlorine-Caustic Soda
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Look over your Pyrometer Equipment!

In the general overhauling of your plant do not overlook your Pyrometer Equipment.

Are your Instruments functioning correctly?

Are they equipped with Brown Automatic Cold Junction Compensation, patented December 28, 1920, licensed under patent No. 869668; which automatically compensates for both cold junction and temperature coefficient errors, or are you still using the old bothersome methods?

Are your Thermocouples in good shape? Do you have sufficient spares?

Have you carefully considered the matter of Brown Automatic Temperature Control which is working so successfully in other glass plants?

Write us at once for any information desired or, we will be glad to have one of our Engineers call and go over your temperature control problem personally—and make suggestions.

The following helpful printed matter sent on request

Brown Pyrometer Catalog No. 14.
Automatic Control of Lehr Temperatures, Folder 22-8.
Brown Pyrometers at American Plate Glass Corp., Folder 22-9.
Brown Automatic Temperature Control at Owens Bottle Co., Folder 22-10.

Write for them now.

Address the Brown Instrument Company, 4513 Wayne Ave., Philadelphia, or one of our District Offices, New York, Boston, Pittsburgh, Cleveland, Columbus, Detroit, Chicago, St. Louis, Birmingham, Houston, Denver, San Francisco, Los Angeles, Montreal.

Brown Pyrometers
Most used in the world

Excellent for Glass House Work

THE NEW ENGELHARD TYPE "S" RECORDER

SIZE: Case is 18" high, 14" wide, 10½" deep.
CHART: Calibrated width is 5¾".
SWITCH: Platinum electrodes, mercury contacts.
CAPACITY: Single and 2, 3, 4 & 6 records.
RECORD: On top of chart. Instantly visible.
RE-ROLL: Chart is automatically rerolled.
CASE: Totally dust and fume proof.
OPERATION: From 100 or 220 volt A.C. or D.C. circuits.

May we send you Bulletin 34-S?

CHARLES ENGELHARD, INC.
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IT took a long time for Pyrometers to fight their way to recognition in the glass trade.

Today Pyrometers are indispensable factors in every modern glass making plant and the question is not "shall we use them?" but "which kind?" When you have to face that question, Bristol's instruments will interest and help you. There is a proper type for every purpose including—

INDICATING, RECORDING AND CONTROLLING TEMPERATURES
IN TANK, FURNACE AND LEHR

BRISTOL Pyrometers possess all the characteristics that distinguish the ordinary good pyrometer and numerous special features besides.

Prof. W. H. Bristol developed the first practical thermo-electric pyrometer and Bristol instruments have kept the lead ever since.

The most important of recent pyrometer improvements—the automatic cold-end compensator—is a Bristol development and is now standard equipment on all Bristol pyrometers. It eliminates cold-end troubles and annoyances and makes possible correct reading of temperatures direct from pyrometer chart.—A big improvement which you should take advantage of.

Full particulars can be had by sending for

Pyrometer Book No. 1401-BK and
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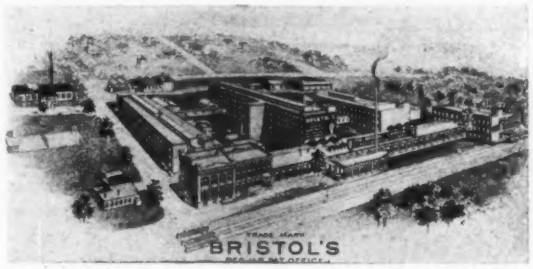

The BRISTOL COMPANY
WATERBURY, CONN.

FOR CUT GLASS

use our

U. S. A. Brand—White Spanish Wheels

SCRATCH WHEELS
White Mexican Sheet Felt.

FINE WORK
Extra Spanish—Fine White Felt.

Wheels are manufactured in all sizes.

Sheet Felt—in strips 3 x 3 x 36—48 or 54" long, or in sheets uncut, 36 x 36—36 x 48—36 x 54.

Goods are Standard, will wear ¼ longer, weigh less per sheet, strip or wheel than our competitors; are evenly felted by Natural Process of shrinkage, and will test 100% wool.

One trial is all that will be required to show why they are
BEST in every TEST

EASTERN FELT COMPANY
MANUFACTURERS

Factory: Winchester, Mass. **Office: 10 High St., Boston, Mass.**

Note the cap:—Not a loose brick or sign of crack, either before or after bringing furnace up to heat.

Of course, this is Russell construction, the kind you can have right now.

Russell Engineering Company

ST. LOUIS, MO.

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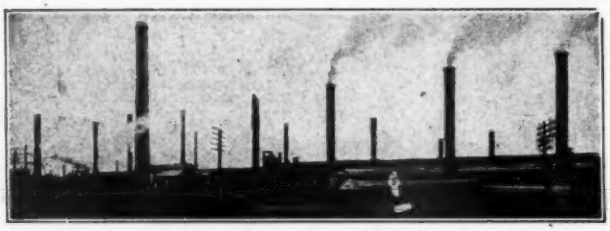
Wiederholdt System of Tile-Concrete Construction

CHIMNEYS

FOR

Glass Furnaces, Power Plants, Etc.

Write for booklet, "The Modern Chimney"



Sixteen Chimneys at Illinois Glass Co., Alton, Ill.

BINS

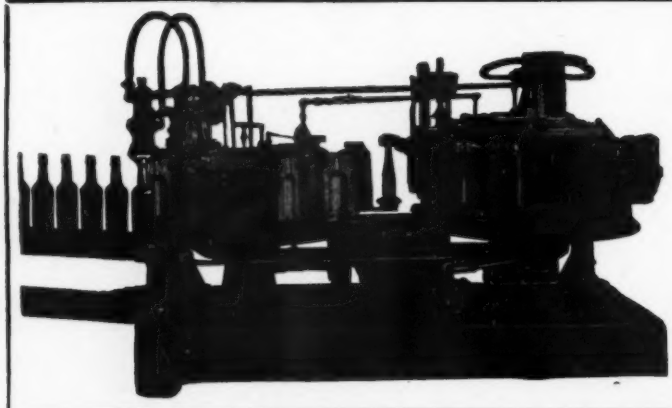
FOR

Batch Material Storage

Send us your Specifications

WIEDERHOLDT CONSTRUCTION CO., 625 Bank of Commerce Bldg., St. Louis, Mo.

NEW YORK OFFICE, 30 CHURCH STREET



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Narrow Neck and Wide Mouth

Bottle Blowing Machines

Strictly Automatic When Operated With Mechanical Feeding Device

Can be Operated by Hand Gatherers

Speed 10 to 32 bottles per minute, ranging in size from ½ oz. to one gallon.

Lynch Glass Machinery Co.

Anderson, Ind. U. S. A.

Cable Address: "LYNCHNOBOY" Anderson.

Codes: A. B. C. Fifth Edition, Bentley's, Western Union

When in need of

MOULDS

for

Bottles	Shades	Vases
Jars	Globes	Tableware
Tumblers	Lenses	Etc.

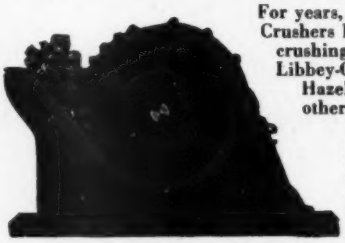
Write to

The Toledo Mould Company

Toledo, Ohio, U. S. A.

Cable Address: "Tomoco"

Williams Glass Crushers



For years, Williams Hinged Hammer Crushers have been the standard for crushing glass in such plants as Libbey-Owens Sheet Glass Co., Hazel-Atlas Glass Co., and many others.

They reduce to 1", ½" or any fineness you wish without preliminary crushing. Size of crushed material also percentage of fine goods can be regulated to suit operator's wishes.

Write for details on a size for your use.

Williams Patent Crusher & Pulverizer Co.

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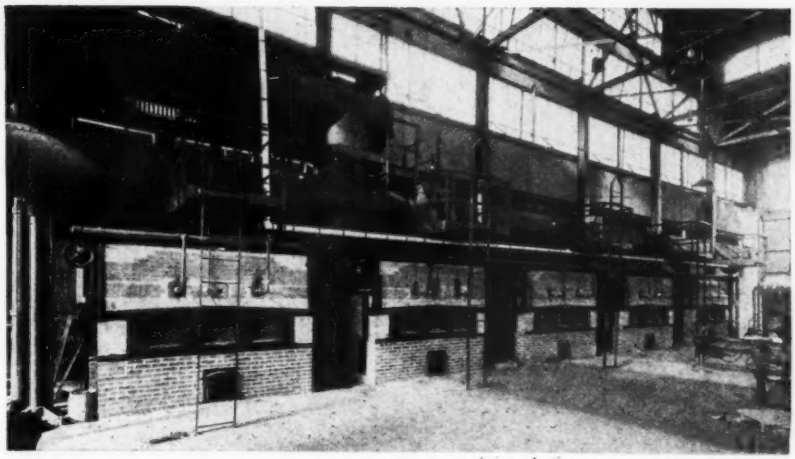

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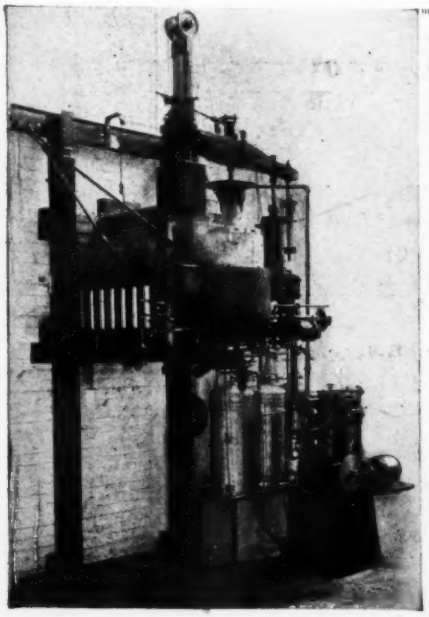

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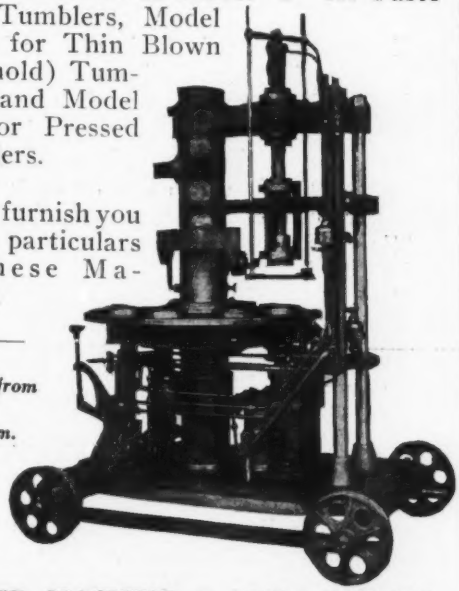

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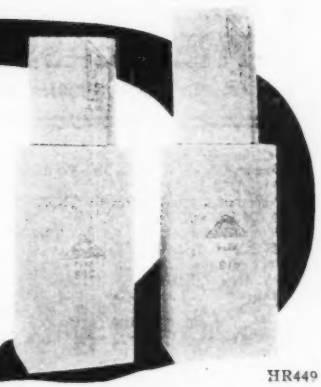

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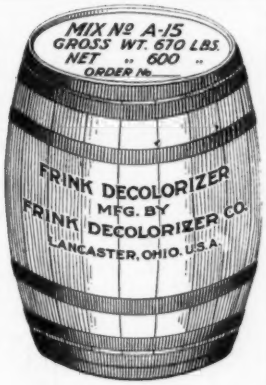

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